Scientific & Technical Writing

SECOND EDITION

EDITED BY

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Chapter One

Introduction

Strong writing is the key to success in any science, research, or technical career. Strong writing conveys information clearly to your audience and turns complex ideas into arguments for action. Someone once said, "those who know *how* will always have a job, but those who know *why* will lead the way." We assume that you will lead the way, as a project manager, researcher, lead investigator, or community organizer. To lead effectively, you will need to use writing as a leadership tool.

We have now entered a "knowledge society" that requires "knowledge workers." According to Peter Drucker, knowledge workers need many complex skills, including:

- the ability "to apply theoretical and analytical abilities"
- "a habit of continuous learning"
- and the ability to manage people and resources by putting information into action

Knowledge workers are assumed to have basic skills, including the compositional and technological literacy to read well, write clearly, and use computers to prepare and distribute information. But they also have the higher level skills that are the hallmarks of a good college education. These skills include being able to:

- analyze new situations, assess information needs, and locate pertinent information
- understand and digest both factual and theoretical material
- think creatively to combine or improve available ideas
- harness knowledge to solve problems

Essentially, knowledge workers know how to access information, synthesize it into knowledge, and make that knowledge usable for others. To do that they need higher order thinking and analytic skills. According to Drucker, they need to:

- work at a high level of abstraction
- learn on their own and independently guide their own learning
- develop and explain complex plans of action to others

Writing helps us communicate to others. It also helps us synthesize knowledge and make it legible and intelligible for ourselves. Sometimes we are not certain of the best course of action until we have information and ideas in front of us where they can be managed and organized. Once we have the information in writing, we can begin to make sense of it and digest it into useful knowledge. That is why the revision process is so important.

A Description of the Course Project

It is our hope that this course will help you to develop as writers, as critical thinkers, and as leaders. The main project you will undertake this semester is the project proposal, which emulates the form of a work-related proposal or a grant proposal. A project proposal is a form of factual and persuasive writing that does the following:

- clearly describes a current problem
- provides a detailed rationale for a specific method to address the problem
- works out a logical, detailed, and budget-conscious plan
- persuades a reader to take action

You must decide upon a topic rather early in the term and have the initiative to carry out the required *independent* research, writing, and revision to finish it. The work you will do for this course is intended to support you through the development process while giving you practice in the oral and written skills you will need in your professional career.

We begin the term by having you write a resume and cover letter so that you can better define your specific career objectives and practice writing to a specific audience. As you prepare your resume, you should begin thinking about a project that connects with your career goals in some way.

Once you write the resume, you will work on developing your project through successively more complex iterations, including:

- an initial proposal
- an annotated bibliography of research
- a midterm paper (in the form of a letter)
- a formal oral presentation with visual aids
- and the project proposal (also called the final paper)

Those students who participate most actively in the revision process end up developing the most sophisticated and creative proposals. Many of our students, in fact, submit their work to executives or community leaders, and we know of several students who have received jobs or promotions due to the projects they have developed in our classes. The more you see your project as something that can actually make a difference in the world, the more the project will make a difference in your education.

Choosing a Topic

Most students are very excited by the prospect of exploring a completely self-chosen project, yet not all are prepared to decide upon a topic right away. To help students discover and develop their topics, we have them engage in exercises, readings, and

activities intended to assist the development process. You are strongly urged to choose a topic that furthers your educational or professional goals. Make this project work for you. Take some time to consider your interests, experiences, and goals. Make appointments with and talk to faculty or advisers in your field of study. Spend some time brainstorming and doing some initial investigations at the library. Do a little "legwork" by calling people who are experts in your field of interest. Read this coursepack to get a better idea of what previous students have done. And talk to your teacher to get a better sense of what sort of projects might work for you.

Use the project to figure out what you want to do in the world and to try doing it. In other words, use the project to begin applying your education.

Practically anything can serve as a viable project, so long as it meets the following criteria:

- You can show that you have identified a realistic problem in your topic area.
- The problem you seek to address is of sufficient complexity to require a long proposal.
- Your topic lends itself to library research (a course requirement).
- You are able to understand advanced research on this topic.
- The specific work you ultimately propose is original (i.e.: you will not represent someone else's work as your own or propose to do a project that has already been completed by yourself or someone else in exactly the same way).
- You can find a real source of interested funding for your project.

You are urged to stay within your reach if not your grasp in generating a course project. Be ambitious, but also be practical. You can't bring about world peace, but you can give employees at your workplace or students at your college better peace of mind, perhaps by starting a wellness program. You can't save the planet from environmental destruction, but you can conduct the bioremediation of a single acre of land. You can't find a cure for cancer, but you can engage in specific research to expand our knowledge of cancer cells. You can't build a tunnel to cross the Atlantic, but you can build a footbridge across a major highway. Keep your project focused and specific.

The Five Parts of the Project Proposal

Most business writers work from models when they prepare their documents. Models are useful because they help a writer fit into an organizational culture, where common formats are expected and easily understood. The sample student papers included in this book can be models for writing, but, like all models, they should not be used as "boiler plate." Models should be seen as benchmarks to measure yourself by. The strongest writers will always challenge themselves to go beyond what has been written before.

Though formats differ from organization to organization, there are always five basic parts to any good project proposal. We call these the "Five P's."

- People
- Problem
- Paradigm
- Plan
- Price

No matter what the specific format for a proposal, it should always help specific *people* address a *problem* by developing *paradigm*-based *plan* of action that stays within specific *price* constraints. Though formats will differ from place to place, all strong project proposals will have these five basic elements. The difficult part of making a strong proposal is having all of the parts fit together into a coherent whole.

We generally encourage students to follow the Five P's format as a description of the process of writing through time. We suggest that you begin with *people* who have a *problem*, then research a *paradigm* of knowledge to address that problem, then use the paradigm to help formulate a *plan*, and then use the plan to help calculate the *price*. But you can also imagine the Five P's spatially, as the parts of a coherent project that might come together in any temporal order. Making the Five P's fit together can sometimes feel like building a structure with five parts. The Five P's are completely inter-dependent entities, so choices in one area impact choices in other areas.

For example, suppose your lab has expanded beyond its present capacity to give experimental space to all who need it. The people in charge of finding a solution to this problem will begin by asking themselves a number of questions: What are the possible options? What innovative approaches (such as time sharing) have others used to solve the problem? What information is needed to make a decision? Where any project begins does not matter as much as where it ends up. And wherever it ends up, it should consider the Five P's: People, Problem, Paradigm, Plan, and Price.

People

Since all projects are socially situated, the first consideration is always the people involved. Who will fund the project? Who will the project affect? Write your project as though you really intended to get it done, and address it to a specific reader (e.g.: someone higher up at your company or someone at a granting agency) who could actually provide the money or assistance needed to accomplish your goals.

Though you may only be writing the project proposal to fulfill the requirements of this class, address your writing to an actual person who could provide funding for your idea. Don't write your paper for the teacher alone; write it for that real-world audience. Find out all you can about your reader. What are your reader's interests, goals, or ideals? What is your reader's bottom line?

Besides your reader, though, there are other people to worry about when writing your project proposal. Projects always affect real world populations. Keep those people in mind as well, and find out all you can about them, too. Sometimes projects have to

balance the concerns of an addressee with what might actually work for a population to be served.

Think about situations that are familiar to you, such as work, school, community, or volunteer organizations with which you are involved. Who would you approach about developing a project for one of these groups? What projects or initiatives are needed? What populations could be better served?

Problem

Remember that you need to address a real-world problem and you need to define that problem and quantify it as best you can. A problem could involve a need to be filled, a goal to be achieved, a question to be explored, or an opportunity to be exploited. Once you have decided upon a problem, you should find out as much as you can about it.

What new trends, ideas, or technologies can your company use to advantage? What problem is affecting your organization, community, or school? If you are currently working full time, you might consider asking your supervisor about the sort of issues your organization is facing now or might face in the future. Assess the organizations that are familiar to you to see what sort of projects might be worth pursuing.

What can you find out about this opportunity or problem? What statistical or factual information do you need to help define it? What has been published about it? Find as much information as you can and work to understand the scale, scope, and significance of the problem you want to address.

Say you wanted to do something about binge drinking at Rutgers. First, you would have to think about the *people* involved: Who might give you money to do something about it? Who would your project seek to help? What are the various combinations of funding agencies and target populations you can imagine?

Next you would have to analyze the *problem*: What statistical or otherwise quantifiable evidence can you find to show that there is a problem? What specific population does it most affect? What have other colleges done about the problem? How is the problem usually understood or approached? What other approaches are available?

Notice how choices in one area affect choices in another. How will decisions about the funding source (the addressee for your proposal) affect the way you approach the problem? How will the choice of populations to be served by the project impact the approach you might take?

Paradigm

The third consideration is the *paradigm*, and students spend most of their time developing this aspect of the project. We can trace our understanding of the paradigm concept to the work of Thomas Kuhn. In his groundbreaking book, *The Structure of Scientific Revolutions*, Kuhn discussed the way paradigms can be both the shared assumptions of scientists (which he later called a "disciplinary matrix") or singular

experiments that support our ideas about the world (which he later called "exemplars"). Precisely because of its plasticity, the paradigm concept has proven useful in many disciplines, even outside of the sciences, as Joel Arthur Barker has argued. We might understand a paradigm as a consensus view or a model, though there are a number of other useful ways of understanding the paradigm concept. *Basically, the plan you choose needs to be justified by a research-based rationale.* Often your paradigm can be summed up in a phrase describing a theory or worldview within a specific discipline, such as the idea of "forest fragmentation" in natural resources management. But it can also emerge through the presentation of successful models (or exemplars) drawn from actual practice, such as a specific study of the effects of forest fragmentation on the behavior of cowbirds which suggests that forest fragmentation might be affecting other arboreal species of birds.

The paradigm concept is especially helpful to students in making the transition from school to work. As Kuhn himself wrote, "The study of paradigms…is what mainly prepares the student for membership in the particular … community with which he will … practice." Insofar as shared paradigms are what constitute communities, they offer students access to the rhetorical and conceptual spaces they will occupy in their careers. If students learn the languages of "integrated pest management" in agriculture, or "experiential learning" in education, or "ecological risk assessment" in environmental planning, or "the broken window theory" in law enforcement, they'll have as much an *entre* into their field as if they learned French before going off to Paris.

If you want to solve a problem, you might ask these questions: How have other people solved this problem in the past? What models of successful practice are available to give me ideas and help justify a plan? What theories or ideas might help me develop a logical approach to this problem? How might language from my discipline help describe and understand the problem?

Let's return to our problem of binge drinking at Rutgers. What information do you need to help understand the problem? What disciplines (e.g.: alcohol studies, psychology, sociology, law enforcement, education, advertising, etc.) could be brought to bear in solving this problem? How might your choice of audience or population to be served impact the way you approach the problem? How might the way you understand the problem (e.g.: within a law enforcement paradigm or a drug counseling paradigm) affect the funding source you choose or the plan you adopt?

Plan

The fourth consideration is the plan itself, which you should develop as the logical extension of the paradigm. This could be a construction project, a training or education program, an experiment to test a hypothesis, a study to determine what course of action is best, or some other specific initiative. Since a good plan will have to grow organically out of the people, problem, and paradigm, it is generally not the first thing you will work on for the project, since it has to be responsive to your research findings.

How you present your plan will have to depend upon the way your project will be implemented. If the project will take place in a series of steps, you might be able to set up a calendar or a list of steps showing the sequence of events. If the plan requires construction, you will probably want to draw a diagram of the thing you are going to build. The plan and the way you present it on paper will have to planned out on a case-by-case basis.

Price

Most research or grant-supported projects, of course, have to contend with the bottom line from the outset, and budgetary constraints often determine the sort of projects that get approved. Unless you are applying for a specific grant as part of your project, though, you will not need to make the budget a central part of your development process in our class. For most students, the budget will simply be a part of the overall plan. You should try to make it as realistic as possible, and you should try your best to get current price information. Sometimes learning how much things actually cost can be one of the biggest lessons of making a budget. Do your best to practice fiscal restraint. You will also want to justify your budget, pointing out any long term cost savings that your project might create.

For example, if you decide to organize an educational campaign to reduce binge drinking on campus, what materials will you need? What labor will be involved? How much will that labor cost?

The Five Ps in Action

You should be prepared to revise your project as you go to make it more coherent. And you should recognize that you won't always follow the Five P's as a step-by-step process. Some students begin with their plan ("I want to build a playground"), and then work backwards in order to supply the paradigm, problem and people that will create a unified project. Students often work in this fashion, and their research often leads them in directions they had not expected.

One former student, we'll call her Sandy, wanted to build a web page for a restaurant where she worked, but she didn't see how that web page could really be used to improve the business. She had begun with the plan ("I want to build a web site"), but that didn't mean she could not succeed in creating a fundable project proposal. After all, a lot of web sites are set up by companies that really don't know why they are building them, except to keep up with the competition. But if she wanted to develop a web site that would actually enhance her employer's restaurant, she would really have to think through the project. Why did the restaurant need a web site? What could the web site do to improve business? Without answers to these questions, the web site could very well become a waste of resources. She had to work on the Five P's.

Sandy already knew the funding source: the restaurant owners would pay to develop a good web site. But she had not yet thought about the people to be served (who are our

customers? do they even have access to the web?), or the problem (how could a web site improve business? what opportunities are we missing out on by not having one?), or the paradigm to guide her (what principles or models of success might give us ideas?)

A good project will always depend on good research. And what Sandy most needed was a paradigm to guide her research.

In her midterm paper, Sandy had made the textbook distinction between "target marketing," which seeks to attract new consumers from a specific group, and "relationship marketing," which involves improving loyalty among the base of consumers who already use your product or service. She suggested that the internet was probably more useful for relationship marketing than for target marketing because of how expensive and difficult it is to reach consumers who haven't already heard of your business. In fact, she recognized it might be easier to attract people to the web site by using the restaurant than to attract people to the restaurant by using the internet.

What Sandy did not recognize right away was that the term "relationship marketing" describes a researchable concept, literally a marketing "paradigm." Sandy had stumbled upon the term in her research, but because she was not a marketing major it had not occurred to her that she could explore that concept further through focused research. To do that, she needed to look at resources in the marketing field and examples of relationship marketing in action. A brief stop at the library index "ABI Inform" (which indexes business sources and even offers full text versions on line and is part of the "ProQuest" database), showed her that there was a wealth of source material within easy reach. A single search turned up 496 potential sources on "relationship marketing" alone. Though she found no examples of restaurants using the concept, she did discover quite a few service-sector models for using a web site to build relationships with loyal customers. One of the best examples she found, described at length in one article, was of a dry cleaner who had a sophisticated web site which not only communicated with customers and served as a site for handling complaints but offered other services that helped to develop a sense of community around the establishment. The site even had a singles meeting page that allowed people going to this dry cleaner to connect with local singles, many of whom would post their pictures both online and in the lobby of the establishment.

The idea Sandy ended up developing was quite creative and went beyond the things she had learned as a computer science major, yet helped her put her major into a larger perspective. After looking at how a number of other companies used their web sites to develop relationships with customers, Sandy was able to synthesize an original yet proven plan for her workplace. She decided to work on developing a sense of community around the restaurant, so that even when customers were not there they could participate in the social life of the institution, developing a relationship with it like the patrons of the television bar "Cheers." To entice current customers to the web site, she would offer them online coupons. Customers visiting the site could e-mail suggestions and complaints directly to the chef, check out the calendar of upcoming events (like *karaoke* night), join the restaurant "listserv" to receive announcements and

advertisements, or check out what was going on at one of the live chat rooms. In a business so much built on loyal customers, "relationship marketing" seemed like the ideal paradigm and a web page the ideal plan. She clearly had a concept worth implementing. But the project didn't come together until she had a paradigm to guide her.

Conducting Your Research

You will be visiting the library at least once this term as a class, and you will spend some time discussing research methods for the project. However, your research will generally be independent. Be ambitious and organized about it. Use all of the Rutgers libraries relevant to your topic. Consult the reference librarians and get their advice on finding the best sources and on finding the specific information that interests you. Try to form a good idea of what you're looking for each time you visit the library, and be prepared to ask the right questions of the librarians. Make use of electronic resources, and use this class as an opportunity to learn more about the resources available in your field. Talk to your advisors or professors to get some help locating the important articles on your topic and discovering a paradigm that can help focus your research and provide a rationale for your plan.

For some projects, substantial "legwork" is needed. You may have to play the role of journalist, making phone calls, setting up interviews, and doing background research. Never be bashful about contacting knowledgeable strangers; they'll almost always be willing to help you and many will be invaluable to the success of your project. Explain to them that you are writing a project for this class, and tell them that you want it to be as "realistic" as possible. Be persistent in securing interviews with the right people and follow-up on contacts promptly in order to avoid delays in gathering necessary information.

Some students find it useful to conduct experiments, surveys or field studies to gather the necessary facts about the problem they want to solve. The sooner you start on such a project, the sooner you'll be able to make use of your results.

Writing the Proposal

This book is designed to help you develop and write your project during the course of the semester. You will be asked to state career goals in writing your resume and cover letter. You will make an initial topic proposal to get feedback from your teacher and the class on your ideas. You will decide upon an audience for your proposal, compile a bibliography on the topic, and develop visual aids to support your argument. At midterm you will submit a midterm paper, which functions in some ways as an initial draft of your project and as a way of bringing together your research into a clear order. Then you will make an oral presentation, which is an "oral draft" of your full project. All of these assignments are intended to bring you through the steps of thinking through and revising

a strong project proposal, which you will polish into its final written form during the last weeks of class.

Many students have been surprised by the amount of work that can go into building the final project. Those who keep up with the deadlines of the class, though, tend to find that the research and writing is not especially onerous. And every student who is devoted to the final project finds that it is an extremely rewarding experience, one that is often described as self-actualizing.

We sincerely hope that you enjoy this course and that you benefit from this book. Your comments and suggestions are always welcome, and we invite your feedback about the course.

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Chapter Two

Readings in Scientific and Technical Writing

Each of the following readings was chosen to facilitate class discussion of the "paradigm concept," which is so central to understanding the social situation of research writing in scientific and technical fields. Joel Arthur Barker's discussion of "paradigms," for example, offers an accessible discussion of Thomas Kuhn's term. Without understanding the paradigm concept, you may have trouble conducting your research and successfully supporting your argument. You might not think to seek out *exemplars of good practice* in your field, such as the land management project described by John Holush in "Turning Brownfields into Fairways and Greens," which could inspire similar work elsewhere to reclaim industrial land. Or you will have trouble envisioning disciplinary *change*, which depends less on what Kuhn calls "normal science" than on what he calls "paradigm shift." A remarkable paradigm shift is described by Judith Hooper in "A New Germ Theory," which explores Paul Ewald's highly original, if sometimes problematic, application of Darwinian theory to describe the origin of many persistent diseases. Of course, any paradigm can lead to dogmatic applications, such as Ewald's consistent if dubious application of his theory to homosexuality. Kirk Johnson describes such paradigm-driven dogmatism in his article on the "return of the natives" movement in parks management, which seeks to restore parts of ecosystems to the way they were before people arrived on the scene. As Hooper and Johnson show, paradigms are rarely without critics, because they can dramatically affect people's lives by shaping collective action and social policy. Any view about such topics as global warming (see Daniel Sarewitz and Roger Pielke, Jr.), organic farming (see Virginia Shepherd), or genetic engineering (see Jeff Wheelwright) will spawn a contrary position because paradigms determine choices that can change people's lives. Paradigms make winners and losers (those whose work is funded and those whose work is not, for example). A good writer will work on managing the sometimes complicated political terrain created by competing, changing, and controversial paradigms in order to make action possible despite inevitable disputes.

Acknowledgements

Joel Arthur Barker. "Defining a Paradigm." Chapter 3 from *Paradigms: The Business of Discovering the Future.* New York: Harper Business, 1993. 30-41.

John Holusha. "Turning Brownfields into Fairways and Greens." *The New Your Times,* Section 11 (Sunday, October 29, 2000): 1-3.

Judith Hooper. "A New Germ Theory." *The Atlantic Monthly* (February 1999): 41-53.

Kirk Johnson. "Return of the Natives: Playing God in the Fields." *The New York Times* Metro (Sunday, November 12, 2000): 37 and 42..

Daniel Sarewitz and Roger Pielke, Jr. "Breaking the Global Warming Gridlock." *The Atlantic Monthly* (July 2000): 55-64.

Virginia Shepherd. "Down on this Farm, the Times They Are A-Changin.'" *Smithsonian* (July 2000): 64-72.

Jeff Wheelwright. "Betting on Designer Genes." *Smithsonian* (January 2001): 29-30, 32-36.

Defining a Paradigm

Joel Arthur Barker

"It's twenty cents, isn't it?"

When I began talking about paradigms in 1974 to corporate audiences, a lot of people asked me why I was wasting my time with such a strange idea. Most people didn't even know how to pronounce the word, much less define it.

Most of the changes on the list in Chapter 2 were driven by a special phenomenon – a switch in paradigms (pronounced pair-a-dimes). And, in the jargon of futurists, they would be called "paradigm shifts."

The concept of paradigms and paradigm shifts can help you better understand the nature of those unexpected changes described in Chapter 2. Being able to understand what caused them will give you a better chance to anticipate other paradigm shifts.

Today, "paradigm" is a buzzword and people use it loosely. But it is not a loose idea.

What is a paradigm? If you look up the word in the dictionary, you discover that it comes from the Greek *paradeigma*, which means "model, pattern, example."

Let me give you some definitions that have appeared in various books since 1962. Thomas S. Kuhn, a scientific historian, and author of *The Structure of Scientific Revolutions*, brought the concept of the paradigm to the scientific world. Kuhn wrote that scientific paradigms are "excepted examples of actual scientific practice, examples which include law, theory, application, and instrumentation together – [that] provide models from which spring particular coherent traditions of scientific research." He adds: "Men whose research is based on shared paradigms are committed to the same rules and standards for scientific practice" (page 10).

Adam Smith's definition, in his *Powers of the Mind*, is: "A shared set of assumptions. The paradigm is the way we perceive the world; water to the fish. The paradigm explains the world to us and helps us to predict its behavior." Smith's point about prediction is important. We will see that most of the time we do not predict things with our paradigms. But paradigms do give us the added advantage of being able to create a valid set of expectations about what will probably occur in the world based on our shared set of assumptions. "When we are in the middle of the paradigm," Smith concludes, "it is hard to imagine any other paradigm" (page 19).

In *An Incomplete Guide to the Future*, Willis Harmon, who was one of the key leaders of the Stanford Research Institute, writes that a paradigm is "the basic way of perceiving, thinking, valuing, and doing associated with a

particular vision of reality. A dominant paradigm is seldom if ever stated explicitly; it exists as unquestioned, tacit understanding that is transmitted through culture and to succeeding generations through direct experience rather than being taught.

In *The Aquarian Conspiracy*, Marilyn Ferguson, who first made her name as editor and publisher of the *New Sense Bulletin*, writes: "A paradigm is a framework of thought . . . a scheme for understanding and explaining certain aspects of reality" (page 26).

Let me offer my definition:

A paradigm is a set of rules and regulations (written or unwritten) that does two things: (1) it establishes or defines boundaries; and (2) it tells you how to behave inside the boundaries in order to be successful.

And how do you measure success?

For most situations success is really measured by your ability to solve problems, problems from trivial to profound. If you think about that definition, you should immediately get a sense of how widely it could be applied. For example: Based on my definition, is the game of tennis a paradigm? If you think about it for a minute, you'll discover that it is. Does the game of tennis have boundaries? Of course, that's the easy part. The tricky part has to do with success and problem solving. What is the problem in tennis? It's the ball coming over the net. And you must solve that problem according to the rules of tennis.

You must hit the problem with the tennis racket; not a baseball bat or your hand or your foot. And if you hit it back over the net so that it drops inside the boundaries on the other side, you have solved the problem. And your successful solution becomes you opponent's problem. In a very real sense, you and your opponent exchange problems until one of you offers the other a problem that he or she cannot solve. Tennis is a paradigm. All games are paradigms. The beauty of games is that the boundaries are so clearly defined and the requirements fir winning – problem solving – are so specific. Games allow for clear winners and losers. It is that aspect that generates much of any game's attraction. It is also that aspect that greatly disconnects them from reality.

Let us look at more important paradigms. Like your field of experience. Almost everyone has one, either at work or at home. You may be an engineer, or a salesperson, or a chef or a carpenter or a nurse or an economist. Are these paradigms?

Again, let us apply the test. What does the word "field" suggest? Boundaries. How do you feel when you are outside your field? Not competent, right? Not competent to do what? Solve problems. Why do people come to you? To receive help from you in solving problems in your field. That sounds like paradigms, doesn't it?

Do artists have paradigms? I used to tease and say artists were just wild and crazy folks. Then I got

straightened out by an artist. She came up after one of my speeches and said, "I'm a sculptor. What do you think the piece of marble I work with is?" I saw that it was her "field" and then realized she was going to work "inside the field" by chiseling into that block of marble. "form" and "balance' and "content" that she had to follow in order to be considered successful.

Since that encounter, I have begun to listen to artist's talk, especially about the "problems" they have solved in their work, whether it is a problem of perspective, or of color, or of tonality, or of character development. Artists have paradigms.

In a sense, I am constructing a hierarchy. At the top sits science and technology. That's where Thomas Kuhn focused. Science and technology deserve top billing because they are so careful with their paradigms, in terms of writing them down, and of developing measurement devices of increasing precision to tell whether they have solved a particular problem.

And, once a scientist has performed a successful experiment, it is expected that he or she should be able to hand the notes and the apparatus to another scientist who should then be able to replicate that experiment, getting the same results.

We would never expect a tennis player to be able to "replicate" Boris Becker's serve by just reading his notes and using the same tennis racket. Or someone to replicate an artist's work by being given the same pigments,

"Okay," I said to her, "but you can do anything you want with that piece of marble."

"Not if I want to be judged successful," she retorted. And then she told me of the rules of "texture" and paintbrushes, and canvas. The requirement of reproducibility constitutes a very important difference between science and all other fields. It results in science and its technologies having much more power to manipulate reality. But, even though they are more powerful, if you apply the definition I offered to science and technology, you will see that it holds true.

Over the years, I have collected words that represent subsets of the paradigm concept. Below they are ordered on a spectrum ranging from challengeable to unchallengeable. You may disagree with my arrangement, but take a look at the words and think about the boundaries and rules and regulations for success that the implicit in them.

Theory
Model
Methodology
Principles
Standards
Protocol
Routines
Assumptions
Conventions
Patterns
Habits
Common Sense
Conventional Wisdom
Mind-set
Values
Frames of Reference

Traditions
Customs
Prejudices
Ideology
Inhibitions
Superstitions
Rituals
Compulsions
Addictions
Doctrine
Dogma

Please note that nowhere in the list do the words "culture," "worldview," "organization," or "business" appear. That is because cultures, worldviews, organizations, and businesses are **forests of paradigms**. IBM is not one paradigm; it is a collection of many. That is true for any business. Large or small, they have management paradigms, sales paradigms, recruitment paradigms, marketing paradigms, research and development paradigms, human resource development paradigms. It goes on but I am sure you get the point. And there are even more paradigms in our cultural life: how we raise our children; how we deal with sex; how we define honesty; the food we eat; the music we listen to.

And the interrelationship of all these paradigms is crucial to the success and longevity of any culture or organization. That is captured in the word "forest" – a highly interdependent structure. As we know from the environmental paradigm, when one thing in the forest is altered, it affects everything else there. So when someone within your organization starts messing with their paradigm and says, "Don't worry, it's got nothing to do with you," start worrying. It is never just one paradigm that is changed.

A paradigm, in a sense, tells you that there is a game, what the game is, and how to play it successfully. The idea of a game is a very appropriate metaphor for paradigms because it reflects the need for borders and directions on how to perform correctly. A paradigm tells you how to play the game according to the rules.

A paradigm shift, then, is a change to a new game, a new set of rules.

It is my belief that changes in paradigms are behind much of society's turbulence during the last thirty years. We had sets of rules we knew well, then someone changed the rules. We understood the old boundaries, then we had to learn new boundaries. And those changes dramatically upset our world.

In *Megatrends*, the best-seller of 1982, John Naisbitt reflects in an indirect way how important paradigm shifts are. Naisbitt suggested that there were ten important new trends that would generate profound changes in our society in the next fifteen to thirty years.

I believe that if your look for what initiated those trends, you will find a paradigm shift. What Naisbitt identifies for us in *Megatrends* is important, because he shows us a pathway of change that we can follow through time to measure how we are getting more of something or less of something.

But even more important than the pathway is our understanding of what instigated that change in the first place. We almost always find that at the beginning of the trend, someone created a new set of rules. The trend toward decentralization is an excellent example of a paradigm shift. The old rules, the old game, required that we "centralize the organization and make the hierarchy complex." But the game ultimately created big problems. Then somebody discovered that there was a different way to deal with the problems, which was to decentralize the organization and simplify the structure; in other words, to change the rules. The result was a paradigm shift.

So if you want to improve your ability to anticipate the future, don't wait for the trends to develop. Instead, **watch for people messing with the rules, because that is the earliest sign of significant change.**

Four Questions

One of the difficulties I have with Thomas Kuhn's *Structure of Scientific Revolutions* is his insistence that paradigms exist only in science. In his afterword, Kuhn takes great pains to talk about all the other disciplines as being "preparadigmatic" because they do not have the exactness of science. And yet, again and again I saw the phenomena he writes about in nonscientific settings and situations. Then I realized that a key element in one of his most powerful examples was not scientific but cultural – a simple deck of cards. The cards were used in a scientific experiment to prove that people have great difficulty perceiving "red" spades and "black" hearts when they are intermixed with standard cards and flashed very quickly to an observer. But even though the experiment was scientific, the objects of the experiment, the cards, are cultural artifacts. And the expectations about the correct colors are cultural expectations, not scientific expectations.

So the experiment was actually a measure of the power of a simple cultural paradigm – the card-deck paradigm – to set up boundaries that dramatically influenced the way the subjects of the experiment saw the anomalous cards.

I am convinced that what Thomas Kuhn discovered about paradigms is a description not just of science but of the human condition.

When we look back to the 1960's, we see nonscientific paradigm shifts: Parents responded so violently to drugs and long hair on their children because these things represented a cultural paradigm shift; we missed the OPEC revolution because of an economic paradigm shift. Our country's inability to understand the Iranian revolution had to do with religious paradigms. Much of the confusion we have about the future is because of changes in paradigms.

These paradigm changes are especially important for all of us because, whether it is in business or education or politics or our personal

lives, a paradigm change, by definition, alters the basic rules of the game.

And, when the rules change, the whole world can change.

The points that Kuhn makes about scientific paradigm shifts are true for any situation where strongly held rules and regulations exist.

I should also add the following disclaimer: I doubt very much if Kuhn appreciates the extent to which I, and others, have generalized his concepts. In his book he states that only in science, where the rules and examples and measures are precise, can paradigms exist. He also contends that only with the subtlety and accuracy possessed by science can changes in paradigms be measured so as to trigger the search for a new paradigm. I accept the obligation imposed by Kuhn's own careful qualification. In spite of his argument to the contrary, I still believe that his observations can be applied in a broader sense with great utility. I hope you will find this true as well.

To frame this broader discussion, we will ask four questions about paradigms:

1. When do new paradigms appear? This question is all about timing. If we can know when the new rules are going to show up, then we can anticipate our future with much greater accuracy. Timing may not be everything, but it's a great place to start.

2. What kind of person is a paradigm shifter? It is as important to understand who are the paradigm shifters, the people who change the rules, as it is to know when they show up. Of the four kinds of paradigm shifters that will be described, three are already inside your organization. But typically, we do not understand how to use them to our advantage. In fact, we usually are very hard on these people.

3. Who are the early followers of the paradigm shifters and why do they follow them? I call these people paradigm pioneers. Without them, paradigm shifts take much longer. Paradigm pioneers bring the critical mass of brainpower and effort and key resources necessary to drive the new rules into reality. Very few of us can be paradigm shifters; many more of us, if we understand our roles, can be paradigm pioneers.

4. How does a paradigm shift affect those who go through it? It is crucial to answer this last question if we are going to understand why there is so much resistance to new paradigms. It also explains the great gulf between old and new paradigm practitioners.

When we have answered these four questions, we will have identified the Paradigm Principles.

Joel Arthur Barker's "Defining a Paradigm" is Chapter 3 from his book *Paradigms: The Business of Discovering the Future.* New York: Harper Business, 1993. 30-41.

Turning Brownfields Into Fairways and Greens

John Holusha

The view is terrific, even if it's from the top of a massive trash heap. The wide swath of the Hudson River and the breathtaking skyline of Manhattan are to the east, and the rolling hills of northern New Jersey march north and west.

If current plans are carried out, this moonscape of construction debris and industrial waste rising from the watery flats known as the Meadowlands will be covered in grassland and bushes and become the home to as many as four golf courses. The project, which would involve more than 900 acres, would be one of the largest reuses in the state of a brownfield, the term for land that has been environmentally contaminated and often abandoned as a result.

Brownfield redevelopment is taking place all over New Jersey, a state whose industrial history has left it with an abundance of contaminated land. Real estate executives say intense demand for sites for retail, commercial and recreational activities -- along with a more realistic attitude on the part of state lawmakers and regulators -- is pushing developers to consider places they would have avoided in the past.

"Brownfields are becoming a major force in the real estate market," said Ira L. Whitman, who heads an environmental consulting company in East Brunswick. He noted that more than 3,000 people attended a recent conference in Atlantic City just to discuss brownfield issues.

"The demand for industrial land is particularly strong," said Paul D. Cohen, an executive vice president of SBWE Inc, a New Jersey-based real estate brokerage. "There are three million square feet under construction or about to start at Exit 8A," he said, referring to the exit of the New Jersey Turnpike in South Brunswick Township that is about 60 miles southwest of New York.

"And that's a second choice for most of them, since they would rather be closer to the city," he added.

The Jersey Gardens outlet mall in Elizabeth is probably the best known brownfield redevelopment in the state. The 225-store mall sits on the site of the old Elizabeth town dump, which was covered with clean dirt and equipped with drainage pipes to prepare for the new structure. Now the company that did the mall site, OENJ-Cherokee, is filling in another old dump, this one in Bayonne, to prepare it for an 18-hole public golf course. It is also attempting to develop land to the east of the mall with 700,000 square feet of modern office space and a ferry link to Manhattan.

Some of these projects are tied to the Port of New York and New Jersey, which is concentrated along the waterfront of the cities of Newark and Elizabeth. Both the Meadowlands and Bayonne golf course projects are based on using material dredged from the harbor to cap the contaminated land.

And as the dredging deepens the port so that it can receive the new generation of large container ships, traffic planners are looking to develop brownfields near the docks to house facilities to handle the larger volumes of cargo. Then, they envision value-added distribution operations that would generate needed jobs in the poorer, urban areas near the port.

In addition to the pressure of the market, real estate executives and consultants say, activity is being generated by developers, financiers and government officials who have become more sophisticated about brownfields in recent years. In particular, they have recognized that a lightly polluted brownfield is different from a heavily contaminated Superfund site, one that has been designated by the Environmental Protection Agency as one of the most dangerous in the nation.

Under Superfund rules, a broad range of companies associated with a site -- owners, concerns that operated plants and companies that dumped waste -- can be made responsible for the entire cost of the cleanup. Thus, developers have been reluctant to get involved with them because of the unknown cost of making a site acceptable, and lenders have often refused to provide financing, because a builder's default might make them the owner of the property -- with the consequent legal and financial responsibility for its cleanup.

The increasing attractiveness of brownfields in New Jersey is in part a result of legislation passed in 1998 under which the state provides financial incentives to promote the reuse of brownfields and does not insist that they be cleaned to a uniform standard. If a site is to remain industrial and is distant from residences, it might have only to be capped with clean material, leaving the contamination enclosed at the site.

Sites that could pose a danger to human health, such as as those near housing or schools, would have to meet a much stiffer standard.

Attitudes toward brownfields vary from state to state. In New York, some planners and architects complain that a law requiring sites to be cleaned to a pristine standard is preventing economic development in places like the South Bronx and Brooklyn.

Ronald Shiffman, director of Pratt Institute's Center for Community and Environmental Development, said such a regulatory climate drives development toward sites in suburban and rural areas that have never been used by industry, bypassing economically needy urban locations.

The Pratt center is part of a group known as the Brownfields Coalition, which proposed legislation that would encourage the establishment of cleanup standards based on how the property would be used and incentives for voluntary cleanups. The bill was not acted upon by the Legislature in Albany, with the result, according to a coalition statement, that "New York is hemorrhaging businesses, jobs and tax revenues to states who have changed the way they do business to encourage private investment in their brownfield sites."

Mr. Shiffman said: "We have prime real estate along the Hudson River and in Greenpoint, Williamsburg and Red Hook that are in need of infrastructure investment and work force training, but it is not happening."

There are few tracts of land in the metropolitan region that have been treated as badly as the New Jersey Meadowlands. Before the value of wetlands as wildlife habitat, flood control systems and water filters was recognized, the Meadowlands were treated as useless swamps, a place to dump unwanted garbage and trash.

The 32-square mile area in Bergen and Hudson Counties is now represented by the Hackensack Meadowlands Development Commission, which has planning and zoning jurisdiction over towns within its borders.

The commission has a tentative agreement with EnCap Golf of Tampa, Fla., to lease the land for 99 years for the golf development in the Meadowlands, which may also include a hotel, time-share condominiums and other development. The company would pay to properly cap old landfills on the site that are leaching contaminated liquid into nearby waterways and emitting methane gas as a result of the decomposition of organic matter. Some of the landfills are considered "orphans" because the towns and private companies that once used them have either disappeared or declined financial responsibility.

"All these landfills were abandoned in the 1970's," said Alan J. Steinberg, executive director of the commission. "Golf is a means of having the private sector pay for closure and to enhance the quality of the Hackensack River watershed." He added that the project would help to improve the appearance of sections of the Meadowlands that are clearly visible from the western spur of the New Jersey Turnpike and would help to reduce ocean pollution by providing an upland site for the disposal of mud dredged from New York harbor as part of the deepening project.

Although heavily developed, the Meadowlands remain that most unusual of locations, an "urban wilderness," Mr. Steinberg said. Some 3,600 acres of the 19,000 acres in the tract remain as open space and most are still wetlands. Commission officials say the remaining wetlands are a vital feeding and resting area for migratory birds passing though the area.

Even on the areas that have long since been despoiled, like the landfills, the Meadowlands' proximity to Manhattan is a big part of its appeal as a recreation area. "EnCap people speak about 'experience tourism,' " Mr. Steinberg said. He said the opportunity to play golf with the Manhattan skyline in the background of the 120 foot high landfill is expected to attract visitors who might also be persuaded to do some eco-touring in the wetlands.

The Meadowlands golf proposal is an indication of the state's increasingly activist approach to brownfield redevelopment, said Jane M. Kenny, New Jersey's commissioner of community affairs and chairwoman of the state's Brownfields Task Force. "We

were overly cautious in the past, but now we are more aggressive," she said.

Development of urban brownfields is tied directly to the effort to preserve open space in the densely crowded state, she said. "We have a goal of preserving one million acres of open space, so the question becomes, where do you grow," Ms. Kenny said. "So brownfields become the flip side of preserving open space." State and local efforts to preserve open space by subjecting developers' plans in rural areas to intense scrutiny can nudge them to look more favorably at brownfields, said Mr. Whitman, the environmental consultant. "Once a developer has financing, timing is important," he said. "If he is facing a 24 month approval time in a suburb versus a 12 month approval in an urban area, he is likely to choose the latter."

Brownfield development nationally is being aided by more sophisticated regulation, said Ronald B. Bruder, president of Brookhill Group, which specializes in developing contaminated properties.

Rather than insisting that all of such a site be cleaned to a pristine standard, he said, regulators are now willing to use devices like deed restrictions to prevent public contact with polluted land.

Nevertheless, he said, redevelopment will always be more difficult than an initial development on a greenfield. "These deals are complicated," he said. "It can take as long as two years to figure out how to deal with a site."

Because of that difficulty, he said, brownfield development is more sensitive to the state of the economy than the rest of the industry. "If the real estate market starts to cool, the brownfield market will cool off a lot faster," Mr. Bruder said.

Mr. Steinberg, the Meadowlands official, said economic development in the Meadowlands is intended to finance preservation of the remaining open space and wetlands. "If a wetland is functional, we are opposed to developing one square inch of it," he said. "If an area is degraded and there is no funding for restoration, we will consider development of a smaller portion of the tract if the developer will mitigate the larger portion."

The first, 36 hole, phase of the golf course plan is intended to close three "orphan" landfills in an environmentally secure manner plus one that is currently in operation.

The second phase would add 36 more holes of golf and include the towering site in North Arlington, where the commission currently operates a landfill accepting construction debris and nontoxic industrial waste. "We are totally self-funded, but we would be happy to get out of the solid waste business and collect lease payments," he said.

William Gauger, the president of EnCap, said the company planned to begin construction of the first Meadowlands golf course next July, with completion expected in July 2005. The expected cost is $70 million to $75 million, he said.

The second phase might be built in parallel with the first, with the second golf course opening in 2007. At least one of the courses will be open to the public, Mr. Gauger said. The project includes a hotel with 500 to 600 rooms, which that would open in 2007, and a marina on the Hackensack.

EnCap Golf is an offshoot of Environmental Capital International, which specializes in supplying capital to environmental concerns. Mr. Gauger said putting golf courses on top of old dumps is a common reuse of such sites, with more than 60 already in operation. One of the oldest is the Marine Park course in Brooklyn, which was built in the early 1960's.

One advantage of putting golf courses, rather than buildings, on old landfills is that there is little danger of damage if the ground subsides. Mr. Gauger said a golf course built on top of 350 feet of garbage in the Los Angeles area has subsided 50 feet in the last 15 years.

Developing golf courses on top of landfills is a way of turning eyesores into assets and increasing the value of adjacent land, Mr. Gauger said. He said the group hoped to do additional development near its golf projects, including office properties.

Brownfield development of a different sort is on the minds of officials of the North Jersey Transportation Planning Authority. Glancing out the window of its offices on the 17th floor of One Newark Center at the industrial tracts to the east in Hudson and Union Counties one day recently, John V. Hummer, the agency's special projects manager, said, "That's all brownfields out there."

The agency, he said, is anticipating a large increase in containerized freight from the Far East as dredging, first to 45 feet and ultimately to 50 feet, allows the ports in Newark and Elizabeth to accommodate a new generation of larger ships. The problem will be moving all that traffic through an already congested area. But there is also an opportunity to capture some economic advantage by doing some processing of that cargo before it leaves the region.

"The projections for traffic growth in the port are astonishing," he said. "It is expected to double in 10 years, and we are already up to the level expected in 2004." In addition to seagoing freight, the adjacent Newark Airport is expected to become one of the nation's air cargo centers.

The agency, a federally funded planning organization that is affiliated with New Jersey Institute of Technology, has a mandate to develop plans to move freight through the region by locating facilities on brownfields.

One of the proposals the agency is studying calls for building a special road, called the Portway, for trucks moving containers from the docks to nearby warehouses and processing centers. This is intended to reduce some of the pressure on the northern stretch of the New Jersey Turnpike, which often resembles a race track for trucks, and to ease congestion on local roads.

Another is to direct more of the traffic, particularly freight traveling long

distances, off the highways and onto trains. "The issue is railyard and rail capacity," Mr. Hummer said. When Conrail was operating the freight system in the Northeast, it shrunk capacity to cut costs, he said. As a result, a rail system in the northern part of New Jersey that could accommodate 250 freight trains a day in 1960 can handle only 70 trains a day at present.

And this is at a time of increased demand for passenger rail service that competes for time and space on the same track system.

The economics of transportation are such that railroads make money only on hauls of over 400 miles, so local distribution will continue to be based on trucks.

This presents an opportunity for brownfield development, Mr. Hummer said. Shippers in the Far East, he said, use the entire capacity of containers "without concern for weight restriction." But, he said "we have weight restrictions, so the containers have to be unpacked and loaded in multiple containers."

As long as the containers are being unpacked, he said, some light processing of the cargo can be done, such as sewing labels on clothing or adding bar codes and labels to goods before they are repacked for transit. "We have an opportunity to add value," he said, "and jobs beyond the usual ones in a warehouse, at locations near the terminal."

Regardless of the final use, brownfield developments have to make sense as real estate deals before the environmental costs are added in, said Andrew W. Savitz, an environmental specialist at PricewaterhouseCoopers, the accounting and consulting firm. "If the real estate does not work, the deal is not going to work," he said. "But if it does, it's good for both the environment and the developer."

John Holusha's article, "Turning Brownfields into Fairways and Greens," appeared in *The New Your Times,* Section 11 (Sunday, October 29, 2000): 1-3.

A New Germ Theory

Judith Hooper

"The dictates of evolution virtually demand that the causes of some of humanity's chronic and most baffling "noninfectious" illnesses will turn out to be pathogens -- that is the radical view of a prominent evolutionary biologist."

A late-September heat wave enveloped Amherst College, and young people milled about in shorts or sleeveless summer frocks, or read books on the grass. Inside the red-brick buildings framing the leafy quadrangle students listened to lectures on Ellison and Emerson, on Paul Verlaine and the Holy Roman Empire. Few suspected that strains of the organism that causes cholera were growing nearby, in the Life Sciences Building. If they had known, they would probably not have grasped the implications. But these particular strains of cholera make Paul Ewald smile; they are strong evidence that he is on the right track. Knowing the rules of evolutionary biology, he believes, can change the course of infectious disease.

In a hallway of the Life Sciences Building an anonymous student has scrawled above a display of glossy photographs and vitae of the faculty, "We are the water; you are but the sponge." This is the home of Amherst's biology department, where Paul Ewald is a professor. He is also the author of the seminal book Evolution of Infectious Disease and of a long list of influential papers. Sandy-haired, trim, and handsome in an all-American way, he looks considerably younger than his forty-five years. Conspicuously outdoorsy for an academic, he would not seem out of place in an L. L. Bean catalogue, with a golden retriever by his side. Ewald rides his bike to the campus every day in decent weather -- and in weather one might not consider decent -- from the nearby hill village of Shutesbury, where he lives with his wife, Chris, and two teenage children in a restored eighteenth-century house.

As far as Ewald is concerned, Darwin's legacy is the most interesting thing on the planet. The appeal of evolutionary theory is that it is a grand unifying principle, linking all organisms, from protozoa to Presidents, and yet its essence is simple and transparent. "Darwin only had a couple of basic tenets," Ewald observed recently in his office. "You have heritable variation, and you've got differences in survival and reproduction among the variants. That's the beauty of it. It has to be true -- it's like arithmetic. And if there is life on other planets, natural selection has to be the fundamental organizing principle there, too."

These Darwinian laws have led Ewald to a new theory: that diseases we have long ascribed to genetic or environmental factors -- including some forms of heart disease, cancer, and mental illness -- are in many cases actually caused by infections. Before we take up this theory, we need to spend a moment with Ewald's earlier work.

Ewald began in typical evolutionary terrain, studying hummingbirds and other creatures

visible to the naked eye. It was on a 1977 field trip to study a species called Harris's sparrow in Kansas that a bad case of diarrhea laid him up for a few days and changed the course of his career. The more he meditated on how Darwinian principles might apply to the organisms responsible for his distress -- asking himself, for instance, what impact treating the diarrhea would have on the vast populations of bacteria evolving within his intestine -- the more obsessed he became. Was his diarrhea a strategy used by the pathogen to spread itself, he wondered, or was it a defense employed by the host -- his body -- to flush out the invader? If he curbed the diarrhea with medication, would he be benefiting the invader or the host? Ewald's paper outlining his speculations about diarrhea was published in 1980, in the *Journal of Theoretical Biology*. By then Ewald was on his way to becoming the Darwin of the microworld.

"Ironically," he says, "natural selection was first recognized as operating in large organisms, and ignored in the very organisms in which it is especially powerful -- the microorganisms that cause disease. The time scale is so much shorter and the selective pressures so much more intense. You can get evolutionary change in disease organisms in months or weeks. In something like zebras you'd have to wait many centuries to see it."

For decades medical science was dominated by the doctrine of "commensalism" -- the notion that the pathogen-host relationship inevitably evolves toward peaceful coexistence, and the pathogen itself toward mildness, because it is in the germ's interest to keep its host alive. This sounds plausible, but it happens to be wrong. The Darwinian struggle of people and germs is not necessarily so benign. Evolutionary change in germs can go either way, as parasitologists and population geneticists have realized -- toward mildness or toward virulence. It was Ewald's insight to realize what we might do about it.

Manipulating the Enemy

Say you're a disease organism -- a rhinovirus, perhaps, the cause of one of the many varieties of the common cold; or the mycobacterium that causes tuberculosis; or perhaps the pathogen that immobilized Ewald with diarrhea. Your best bet is to multiply inside your host as fast as you can. However, if you produce too many copies of yourself, you'll risk killing or immobilizing your host before you can spread. If you're the average airborne respiratory virus, it's best if your host is well enough to go to work and sneeze on people in the subway.

Now imagine that host mobility is unnecessary for transmission. If you're a germ that can travel from person to person by way of a "vector," or carrier, such as a mosquito or a tsetse fly, you can afford to become very harmful. This is why, Ewald argues, insect-borne diseases such as yellow fever, malaria, and sleeping sickness get so ugly. Cholera uses another kind of vector for transmission: it is generally waterborne, traveling easily by way of fecal matter shed into the water supply. And it, too, is very ugly.

"Here's the [safety] hood where we handle the cholera," Jill Saunders explained as we toured the basement lab in Amherst's Life Sciences Building where cholera strains are stored in industrial refrigerators after their arrival from hospitals in Peru, Chile, and Guatemala. "We always wear gloves." A medical-school-bound senior from the Boston suburbs, Saunders is one of Ewald's honor students. As she guided me around, pointing out centrifuges, -80 degree freezers, and doors with BIOHAZARD warnings, we passed a closet-sized room as hot and steamy as the tropical zones where hemorrhagic fevers thrive. She said, "This is the incubation room, where we grow the cholera."

Cholera invaded Peru in 1991 and quickly spread throughout South and Central America, in the process providing a ready-made experiment for Ewald. On the day of my tour Saunders had presented to the assembled biology department her honors project, "Geographical Variations in the Virulence of *Vibrio cholerae* in Latin America." The data compressed in her tables and bar graphs were evidence for Ewald's central thesis: it is possible to influence a disease organism's evolution to your advantage. Saunders used a standard asSay, called ELISA, to measure the amount of toxin produced by different strains of cholera, thus inferring the virulence of *V. cholerae* variants from several Latin American regions. Then she and Ewald looked at figures for water quality -- what percentage of the population had potable water, for example -- and looked for correlations. If virulent strains correlated with a contaminated water supply, and if, conversely, mild strains took over where the water was clean, the implication would be that *V. cholerae* becomes increasingly mild when it cannot use water as a vector. When the pathogen is denied easy access to new hosts through fecal matter in the water system, its transmission depends on infected people moving into contact with healthy ones. In this scenario the less-toxic variants would prevail, because these strains do not incapacitate or kill the host before they can be spread to others. If this turned out to be true, it would constitute the kind of evidence that Ewald expected to find.

The dots on Saunders's graphs made it plain that cholera strains are virulent in Guatemala, where the water is bad, and mild in Chile, where water quality is good. "The Chilean data show how quickly it can become mild in response to different selective pressures," Ewald explained. "Public-health people try to keep a disease from spreading in a population, and they don't realize that we can also change the organism itself. If you can make an organism very mild, it works like a natural vaccine against the virulent strains. That's the most preventive of preventive medicine: when you can change the organism so it doesn't make you sick." Strains of the cholera agent isolated from Texas and Louisiana produce such small amounts of toxin that almost no one who is infected with them will come down with cholera.

Joseph Schall, a professor of biology at the University of Vermont, offers a comment on Ewald's work: "If

Paul is right, it may be that the application of an evolutionary theory to public health could save millions of lives. It's a stunning idea. If we're able to manipulate the evolutionary trajectory of our friends -- domestic animals and crops -- why not do the same with our enemies, with cholera, malaria, and HIV? As Thomas Huxley said when he read Darwin, "How stupid of me not to have thought of that before." I thought when I heard Paul's idea, "Gee, why didn't *I* think of that?"

Ewald put forward his virulence theories in *Evolution of Infectious Disease.* Today his book is on the syllabus for just about every college course in Darwinian medicine or its equivalent. "I regard him as a major figure in the field," says Robert Trivers, a prominent evolutionary biologist who holds professorships in anthropology and biology at Rutgers University. "It is a shame his work isn't better known to the public-health and medical establishments, who are willfully ignorant of evolutionary logic throughout their training." While praising Ewald's boldness and originality, some of his peers caution that his data need to be independently corroborated, and others object that his hypotheses are too crude to capture the teeming complexity of microbial evolution. "Evolutionary biologists have had very poor success in explaining how an organism evolves in response to its environment," says James Bull, an evolutionary geneticist at the University of Texas. "Trying to understand a two-species interaction should be even more complicated."

Recently, in any case, Ewald has adopted a new cause, far more radical but equally rooted in evolution. Let's call it Germ Theory, Part II. It offers a new way to think about the causes of some of humanity's chronic and most baffling illnesses. Ewald's view, to put it simply, is that the culprits will often turn out to be pathogens -- that the dictates of evolution virtually demand that this be so.

The Case for Infection

Germ Theory, Part I, the edifice built by men like Louis Pasteur, Edward Jenner, and Robert Koch, took medicine out of the Dark Ages. It wasn't "bad air" or "bad blood" that caused diseases like malaria and yellow fever but pathogens transmitted by mosquitoes. Tuberculosis was famously tracked to an airborne pathogen, *Mycobacterium tuberculosis,* by Robert Koch, the great German scientist who in 1905 won a Nobel Prize for his work. Koch also revolutionized medical epidemiology by laying out his famous four postulates, which have set the standard for proof of infectivity up to the present day. The postulates dictate that a microbe must be (a) found in an animal (or person) with the disease; (b) isolated and grown in culture; (c) injected into a healthy experimental animal, producing the disease in question; and then (d) recovered from the experimentally diseased animal and shown to be the same pathogen as the original.

By the early twentieth century the whole landscape had changed. Most of the common killer diseases, including smallpox, diphtheria, bubonic plague, flu, whooping cough, yellow fever, and

TB, were understood to be caused by pathogens. Vaccines were devised against some, and by the 1950s antibiotics could easily cure many others. Smallpox was actually wiped off the face of the earth (if you don't count a few strains preserved in laboratories in the United States and Russia).

By the 1960s and 1970s the prevailing mood was one of optimism. Ewald is fond of quoting from a 1972 edition of a classic medical textbook: "The most likely forecast about the future of infectious disease is that it will be very dull." At least in the developed world, infectious diseases no longer seemed very threatening. Far scarier were the diseases that the medical world said were not infectious: heart disease, cancer, diabetes, and so on. No one foresaw the devastation of AIDS, or the serial outbreaks of deadly new infections such as Legionnaire's disease, Ebola and Marburg hemorrhagic fevers, antibiotic-resistant tuberculosis, "flesh-eating" staph infections, hepatitis C, and Rift Valley fever.

The infectious age is, we now know, far from over. Furthermore, it appears that many diseases we didn't think were infectious may be caused by infectious agents after all. Ewald observes,"By guiding researchers down one path, Koch's postulates directed them away from alternate ones. Researchers were guided away from diseases that might have been infectious but had little chance of fulfilling the postulates." That is, just because we couldn't readily discover their cause, we rather arbitrarily decided that the so-called chronic diseases of the late twentieth century must be hereditary or environmental or "multifactorial." And, Ewald contends, we have frequently been wrong.

Germ Theory, Part II, as conceived by Ewald and his collaborator, Gregory M. Cochran, flows from the timeless logic of evolutionary fitness. Coined by Darwin to refer to the fit between an organism and its environment, the term has come to mean the evolutionary success of an organism relative to competing organisms. Genetic traits that may be unfavorable to an organism's survival or reproduction do not persist in the gene pool for very long. Natural selection, by its very definition, weeds them out in short order. By this logic, any inherited disease or trait that has a serious impact on fitness must fade over time, because the genes that spell out that disease or trait will be passed on to fewer and fewer individuals in future generations. Therefore, in considering common illnesses with severe fitness costs, we may presume that they are unlikely to have a genetic cause. If we cannot track them to some hostile environmental element (including lifestyle), Ewald argues, then we must look elsewhere for the explanation. "When diseases have been present in human populations for many generations and still have a substantial negative impact on people's fitness," he says, "they are likely to have infectious causes."

Although its fitness-reducing dimensions are difficult to calculate, the ordinary stomach ulcer is the best recent example of a common ailment for which an infectious agent -- to the surprise of

almost everyone -- turns out to be responsible.

When I visited him one afternoon, Ewald pulled off his shelves a standard medical textbook from the 1970s and opened the heavy volume to the entry on peptic ulcers. We squinted together at a gray field of small print punctuated by subheads in boldface. Under "Etiology" we scanned several pages: *environmental factors ... smoking ... diet ... ulcers caused by drugs ... aspirin ... psychonomic factors ... lesions caused by stress.* In the omniscient tone of medical texts, the authors concluded, "It is plausible to hypothesize a wealth of these factors.... " There was no mention of infection at all.

In 1981 Barry J. Marshall was training in internal medicine at the Royal Perth Hospital, in Western Australia, when he became interested in incidences of spiral bacteria in the stomach lining. The bacteria were assumed to be irrelevant to ulcer pathology, but Marshall and J. R. Warren, a histopathologist who had previously observed the bacteria, reviewed the records of patients whose stomachs were infected with large numbers of these bacteria. They noticed that when one patient was treated with tetracycline for unrelated reasons, his pain vanished, and an endoscopy revealed that his ulcer was gone.

An article by Marshall and Warren on their culturing of "unidentified curved bacilli" appeared in the British medical journal *The Lancet* in 1984, and was followed by other suggestive studies. For years, however, the medical establishment remained deaf to their findings, and around the world ulcer patients continued to dine on bland food, swear off stress, and swill Pepto-Bismol. Finally Marshall personally ingested a batch of the spiral bacteria and came down with painful gastritis, thereby fulfilling all of Koch's postulates.

There is now little doubt that *Helicobacter pylori,* found in the stomachs of a third of adults in the United States, causes inflammation of the stomach lining. In 20 percent of infected people it produces an ulcer. Nearly everyone with a duodenal ulcer is infected. *H. pylori* infections can be readily diagnosed with endoscopic biopsy tests, a blood test for antibodies, or a breath test. In 90 percent of cases the infections can be cured in less than a month with antibiotics. (Unfortunately, many doctors still haven't gotten the news. A Colorado survey found that 46 percent of patients seeking medical attention for ulcer symptoms are never tested for *H. pylori* by their physicians.)

Antibiotics Against Heart Disease?

Ewald closed the medical textbook on his knee. "This was published twenty years ago," he said. "If we looked up 'atherosclerosis' in a textbook from ten years ago, we'd find the same kind of things -- stress, lifestyle, lots about diet, nothing about infection."

Heart disease is now being linked to *Chlamydia pneumoniae,* a newly discovered bacterium that causes pneumonia and bronchitis. The germ is a

relative of *Chlamydia trachomatis,* which causes trachoma, a leading cause of blindness in parts of the Third World. *C. trachomatis* is perhaps more familiar to us as a sexually transmitted disease that, left untreated in women, can lead to scarring of the fallopian tubes, pelvic inflammatory disease, ectopic pregnancy, and tubal infertility.

Pekka Saikku and Maija Leinonen, a Finnish husband-and-wife team who have evoked comparisons to the Curies, discovered the new type of chlamydial infection in 1985, though its existence was not officially recognized until 1989. Saikku and Leinonen found that 68 percent of Finnish patients who had suffered heart attacks had high levels of antibodies to *C. pneumoniae,* as did 50 percent of patients with coronary heart disease, in contrast to 17 percent of the healthy controls. "We were mostly ignored or laughed at," Saikku recalls.

While examining coronary-artery tissues at autopsy in 1991, Allan Shor, a pathologist in Johannesburg, saw "pear-shaped bodies" that looked like nothing he'd ever seen before. He mentioned his observations to a microbiologist colleague, who had read about a new species of chlamydia with a peculiar pear shape. The colleague referred Shor to an expert on the subject, Cho-Chou Kuo, of the University of Washington School of Public Health, in Seattle. After Shor shipped Kuo the curious coronary tissue, Kuo found that the clogged coronary arteries were full of *C. pneumoniae.* Before long, others were reporting the presence of live *C. pneumoniae* in arterial plaque fresh from operating tables. Everywhere the bacterium lodges, it appears to precipitate the same grim sequence of events: a chronic inflammation, followed by a buildup of plaque that occludes the opening of the artery (or, in the case of venereal chlamydia, a buildup of scar tissue in the fallopian tube). Recently a team of pathologists at MCP-Hahnemann School of Medicine, in Philadelphia, found the same bacterium in the diseased sections of the autopsied brains of patients who had had late-onset Alzheimer's disease: it was present in seventeen of nineteen Alzheimer's patients and in only one of nineteen controls.

By the mid-1990s a radical new view was emerging of atherosclerosis as a chronic, lifelong arterial infection. "I am confident that this will reach the level of certainty of ulcer and *H. pylori,*" says Saikku, who estimates that at least 80 percent of all coronary heart disease is caused by the bacterium. Big questions remain, of course. Studies show that about 50 percent of U.S. adults carry antibodies to *C. pneumoniae* -- but how many will develop heart disease? Even if heart patients can be shown to have antibodies to *C. pneumoniae,* and even if colonies of the bacteria are found living and breeding in diseased coronary arteries, is it certain that the germ *caused* the damage? Perhaps it's an innocent bystander, as some critics have proposed; or a secondary, opportunistic infection.

But suppose that a *Chlamydia pneumoniae* infection during childhood can initiate a silent, chronic infection of the coronary arteries, resulting in a "cardiovascular event" fifty years later.

Could antibiotics help to address the problem?

A few early studies suggest they might. Researchers in Salt Lake City infected white rabbits with *C. pneumoniae,* fed them a modestly cholesterol-enhanced diet, killed them, and found thickening of the thoracic aortas, in contrast to the condition of uninfected controls fed the same diet. Additionally, treatment of infected rabbits with antibiotics in the weeks following infection prevented the thickening. Saikku and colleagues reported a similar finding, also in rabbits. Coronary patients in Europe who were treated with azithromycin not only showed a decline in antibodies and other markers of infection but in some studies had fewer subsequent cardiovascular events than patients who were given placebos. (These findings are preliminary; in a few years we may know more. The first major clinical trial is under way in the United States, sponsored by the National Institutes of Health and the Pfizer Corporation: 4,000 heart patients at twenty-seven clinical centers will be given either the antibiotic azithromycin or a placebo and followed for four years to gauge whether the antibiotic affects the incidence of further coronary events.)

Smoking, stress, cholesterol, and heredity all play a role in heart disease. But imagine if our No. 1 killer -- with its vast culture of stress-reduction theories, low-fat diets, high-fiber cereals, cholesterol-lowering drugs, and high-tech bypass surgery -- could in many instances be vanquished with an antibiotic. Numerous precedents exist for long-smoldering bacterial infections with consequences that appear months or years later. Lyme disease, leprosy, tuberculosis, and ulcers have a similar course. Ewald is confident that the association of *C. pneumoniae* and heart disease is real. He doesn't believe that the germ is an innocent bystander. "It reminds you a lot of gonorrhea in the 1890s," he says. "When they saw the organism there, people said, 'Well, we don't know if it's really causing the disease, or is just living there.' Every month the data are getting stronger. This is a smoking gun, just like *Helicobacter.*"

Evolutionary Byways

I have a motto," Gregory Cochran told me recently. "'Big old diseases are infectious.' If it's common, higher than one in a thousand, I get suspicious. And if it's old, if it has been around for a while, I get suspicious."

The fact that Ewald has dared to conceive of a big theory for the medical sciences owes much to Cochran's contributions. A forty-five-year-old Ph.D. physicist who lives in Albuquerque with his wife and three small children, Cochran makes a living doing contract work on advanced optical systems for weaponry and other devices. Whereas Ewald is an academic insider, with department meetings to attend and honors theses to monitor, Cochran is a solo player, with an encyclopedic mind (he is a former College Bowl contestant) and a manner that verges on edginess. These days he spends a lot of time at his computer, as rapt as a conspiracy theorist, cruising Medline for new data

on infectious diseases and, one imagines, almost cackling to himself when he finds something really good. Cochran's background in a field dominated by grand theories and universal laws may serve as a valuable counterpoint to the empirical and theory-hostile universe of the health sciences.

Ewald and Cochran encountered each other serendipitously, after Cochran decided to pursue a certain line of thinking about a very sensitive subject. "I was reading an article in *Scientific American* in 1992 about pathogens manipulating a host to get what they want," Cochran recalls. "It described a flowering plant infected by a fungus, and the fungus hijacks the plant's reproductive machinery so that instead of pollen it produces fungal spores. I thought, *Could it be?*" Cochran strayed from his field to try his hand at writing an article on biology -- elaborating an audacious theory that human homosexuality might result from a "manipulation" of a host by a germ with its own agenda. He sent his draft to a prestigious biology journal, which sent it out to three scientists for peer review. Two were unconvinced, even appalled; the third was Paul Ewald, who thought the article was flawed but who was nonetheless impressed by the logic of the idea. The article was rejected, but Ewald and Cochran began their association.

To illustrate his thinking about infectiousness and disease, Cochran not long ago gave me a tour of his conceptual bins, into which he sorts afflictions according to their fitness impact. Remember that fitness can be defined as the evolutionary success of one organism relative to competing organisms. Only one thing counts: getting one's genes into the future. Any disease that kills host organisms before they can reproduce reduces fitness to zero. Obviously, fitness takes a major hit whenever the reproductive system itself is involved, as in the case of venereal chlamydia.

Consider a disease with a fitness cost of one percent -- that is, a disease that takes a toll on survival or reproduction such that people who have it end up with one percent fewer offspring, on average, than the general population. That small amount adds up. If you have an inherited disease with a one percent fitness cost, in the next generation there will be 99 percent of the original number in the gene pool. Eventually the number of people with the disease will dwindle to close to zero -- or, more precisely, to the rate produced by random genetic mutations: about one in 50,000 to one in 100,000.

We were considering the bin containing diseases that are profoundly antagonistic to fitness, with a fitness cost of somewhere between one and 10 percent by Cochran's calculations. My eye took in a catalogue of human ills -- some familiar, some exotic, some historically fearsome but close to extinct, some lethal in the tropics but of little concern to inhabitants of the temperate zones. This list also showed prevailing medical opinion about cause. Each name of a disease was trailed by a lower-case letter: *i* (for infectious), *g*(genetic), *g*+(genetic defense against an infectious disease), *e* (caused by an environmental agent), or *u* (unknown). I read,

"Atherosclerosis (*u*), ... chlamydia (venereal) (*i*), cholera (*i*), diphtheria (*i*), endometriosis (*u*), filariasis (*i*), G6PD deficiency (*g+*), ... hemoglobin E disease (*g+*), hepatitis B (*i*), hepatitis C (*i*), hookworm disease (*i*), kuru (*i*), ... malaria (vivax) (*i*), ... pertussis (*i*), pneumococcal pneumonia (*i*), polycystic ovary disease (*u*), scarlet fever (*i*), ... tuberculosis (*i*), typhoid (*i*), yellow fever (*i*)."

Of the top forty fitness-antagonistic diseases on the list, thirty-three are known to be directly infectious and three are indirectly caused by infection; Cochran believes that the others will turn out to be infectious too. The most fitness-antagonistic diseases must be infectious, not genetic, Ewald and Cochran reason, because otherwise their frequency would have sunk to the level of random mutations. The exceptions would be either diseases that could be the effect of some new environmental factor (radiation or smoking, for example), or genetic diseases that balance their fitness cost with a benefit. Sickle-cell anemia is one example of the latter.

Though sickle-cell anemia is strictly heritable according to Mendelian laws, it is widely believed to have persisted in the population in response to infectious selective pressures. It heads the list of genetic diseases that Ewald dubs "self-destructive defenses," in which a disease fatal in its homozygous form (two copies of the gene) carries an evolutionary advantage to heterozygous carriers (with one copy), protecting against a terrible infection: in this case falciparum malaria, common in Africa. Similarly, cystic fibrosis, some argue, evolved in northern Europe as a defense against *Salmonella typhi,* the cause of typhoid fever. Infection thus explains why these deadly genetic diseases have remained in the human gene pool when they should have died out.

But what about something like atherosclerosis? I asked. Leaving aside the evidence concerning *C. pneumoniae,* it is not apparent why a genetic cause for atherosclerosis should be dismissed out of hand on evolutionary grounds. If it hits people in midlife or later, after they have launched their genes, how could it possibly affect fitness?

Cochran's response illustrates some of the intricacies of evolutionary thinking. "Well, obviously, it's not as bad as a disease that kills you before puberty, but I think it does have a fitness cost. First of all, it's *really* common. Second, people think that all you have to do to pass your genes along is have children, but that's not true. You still need to raise the offspring to adulthood. In a hunter-gatherer or subsistence-farming culture, the fitness impact of dying in midlife might be considerable, especially during bad times, like famines. You've got to feed your family. Also, cardiovascular disease is a leading cause of impotence, and any disease that makes males impotent at age forty-five has got to affect reproduction somewhat."

But fifty-year-olds? Sixty-year-olds?

Grandmothers do a large proportion of the food-gathering in some

tribal cultures, according to recent anthropological reports. "They aren't hampered by babies anymore, and they don't have to go around chucking spears like the men," says George C. Williams, a professor emeritus of ecology and evolution at the State University of New York at Stonybrook, and one of the pillars of modern evolutionary biology. "They contribute substantially to the family diet." If long-lived elders historically have made a difference by fostering the survival of their descendants, and therefore their genes, Cochran figures, then a disease that kills sixty-year-olds could have a fitness impact of around one percent.

The Cause-and-Effect Conundrum

Know what that is?" Ewald asked. We were standing in the main corridor of the Life Sciences Building, gazing up at a decorative metalwork frieze that runs along the walls just above door height. A pair of hummingbirds chase each other in a circle. A human eye and an octopus eye face off. A human hand is juxtaposed with a chimpanzee hand. Ewald pointed to something that looked like a daddy longlegs with a video camera for a head. "Some kind of insect?" I ventured. "It's a virus," he said. "See, it's like a spaceship. That" -- he pointed at the head -- "is its DNA. It injects it inside the cell."

There is something unsettling and fascinating about a virus, an organism that is neither strictly alive nor strictly inanimate, and that replicates by sneaking inside a host cell and commandeering its machinery. "Viruses are essentially bits of nucleic acid -- either DNA or RNA -- wrapped in a protein capsule," Ewald explained. "A retrovirus, like HIV, is an RNA virus with a protein called reverse transcriptase built into it, and once it gets into a cell, it uses the reverse transcriptase to make a DNA copy of its RNA. This viral DNA copy can insert itself into our DNA, where it can be read by our protein-making machinery the same way our own instructions are read."

The modus operandi of the world's most feared virus, HIV, is clever, killing its hosts very, very slowly. A sexually transmitted pathogen, without the luxury of being spread through sneezes or coughs, must await its few opportunities patiently; if those infected have no symptoms and don't know they are sick, so much the better. A mild, chronic form of AIDS had in all likelihood been around for centuries in Africa, according to Ewald. Suddenly in the 1970s -- owing to changing patterns of sexual activity and to population movements -- deadly strains spread in the population of Central and East Africa.

HIV has an extremely high mutation rate, which means that it is continually evolving, even within a single patient, producing competing strains that fight for survival against the weapons produced by the immune system. If selective pressures -- in this case a high potential sexual transmission -- have forced the virus to evolve toward virulence, the opposite selective pressures could do the reverse. Conceivably, we could "tame" HIV,

encouraging it to evolve toward comparative harmlessness. It was already known that preventive measures such as safe sex, fewer partners, clean needles, and so forth could curb the spread of the disease. But Ewald pointed out early on that social modification was a far more potent weapon than anyone realized. Once HIV was cut off from easy access to new hosts, milder strains would flourish -- ones that the host could tolerate for longer and longer periods. Indeed, Ewald argues, given limited public-health budgets, it might make sense to put more money into transmission-prevention programs and less into the search for vaccines. (He also has strong opinions about how drugs should be used to treat AIDS. He asserts that every time we use an antiviral drug like AZT, we produce an array of AZT-resistant HIVs in the population; if viral evolution is taken into account, antiviral drugs can be used more judiciously.)

Ewald's theories tilt him decidedly toward the optimistic camp. Even in the absence of a vaccine the AIDS epidemic will not inevitably worsen; it can be curbed without reducing transmission to zero. A natural experiment now occurring in Japan, he says, could be a test case for his theories. In the early 1990s highly virulent strains of HIV from Thailand took root in Japan, but Ewald predicts that low rates of sexual transmission in that country -- due to widespread condom use and other factors -- will act as a selective pressure on these strains so that they evolve toward mildness. If this is true, the trend should become evident over the next ten years.

Like HIV, many other viruses have an indolent course, with a long latency between infection and the development of symptoms. Herpes zoster, the agent of chicken pox, lingers in the body forever, capable of erupting as painful shingles decades later. There are also so-called hit-and-run infections, in which a pathogen or its products disrupt the body's immunological surveillance system; once the microbes are gone (or when they are present in such low frequency as to be undetectable), the immune response stays stuck in the "on" mode, causing a lingering inflammation. By the time symptoms occur, the microorganism itself has disappeared, and its genome will not be detectable in any tissue.

"The health sciences are still grappling with the masking effects of long delays between the onset of infection and the onset of disease," Ewald says. "Any time you have hit-and-run infections, slow viruses, lingering or relapsing infections, or a time lag between infection and symptoms, the cause and effect is going to be very cryptic. You won't find these newly recognized infections by the methods we used to find old infectious diseases. We have to be ready to think of all sorts of new, clever ways to identify pathogens. We will have to abandon Koch's postulates in some cases."

The Great Synthesizer

As of this writing, the ideas at the core of Germ Theory, Part II, have been presented by Ewald mostly in the form of lectures, and in communications with colleagues. The papers in which the

ideas will be formally articulated are in preparation. Given Ewald's prominence, the ideas are bound to cause a stir. They will also draw criticism. In the medical sciences, where "theory" is a bad word and "Stick to the data" is the reigning motto, Ewald will come under particular scrutiny because his hypothesis arrives detached from a vast corpus of laboratory data. It is helpful to think of Ewald as continuing the tradition of the great scientific synthesizers. Darwin himself was a synthesizer extraordinaire, who composed the thesis of *The Origin of Species* largely out of hundreds of odds and ends contributed by others, from pigeon breeders to naturalists. "Professor So-and-so has observed ... " is a recurring motif in Darwin's book.

Ewald's theory about evolution and infectiousness provides a framework that potentially unites diverse research on the front lines of various afflictions. Ulcers and heart disease have already been mentioned. Here are two more: cancer and mental illness.

In 1910 a man named Peyton Rous discovered the eponymous Rous sarcoma virus, demonstrating that chickens infected with it developed cancer. Over the years many other cancer viruses have been discovered in animals. And yet until 1979, despite broad hints from the animal world, not a single human cancer was generally accepted as infectious. Rous had been lucky: his chickens became sick only two weeks after infection. Human cancers follow a more languorous course, which means that by the time symptoms show up, any infectious causation may well be buried under a lifetime of irrelevant risk factors.

In 1979 HTLV-1, a retrovirus endemic in parts of Asia, Africa, and the Caribbean, and transmitted either sexually or from mother to child, was linked to certain leukemias and lymphomas; the cancer appeared decades after infection. The Epstein-Barr virus (the agent that causes mononucleosis) has now been associated with some B-cell lymphomas, with a nasopharyngeal cancer common in south China, and with Burkitt's lymphoma, a deadly childhood cancer of Africa. Some 82 percent of all cases of cervical cancer have been associated with the sexually transmitted human papilloma virus, a once relatively innocent-seeming pathogen responsible for genital warts.

H. pylori, the ulcer pathogen, confers a sixfold greater risk of stomach cancer, and accounts for at least half of all stomach cancers. Also, the lymphoid tissue of the stomach can produce a low-grade gastric lymphoma under the influence of this bacterium. Early reports indicate that the lymphoma is cured in 50 percent of cases by resolving the *H. pylori* infection -- which may mark the first time in medical history that cancer has been cured with an antibiotic.

Hepatitis B and C, two of the ever-growing alphabet soup of hepatic diseases, have been linked to liver cancer. Herpes virus 8 has recently been discovered to be the cause of Kaposi's sarcoma. "There is no reason to believe that this flurry of discovery has now completed the list of infectious agents of cancer," Ewald says.

Among the many known animal cancer viruses is a closely studied retrovirus known as mouse mammary tumor virus (MMTV), which causes mammary-gland cancer in mice. This virus is transmitted from mother to offspring through mother's milk, lying latent in the daughter's mammary tissue until activated by hormones during her own lactation. Could such a virus be a factor in human breast cancer? In the mid-1980s researchers announced that they had found in malignant human breast tumors a DNA sequence resembling MMTV, but the excitement waned when the same sequence was found in normal breast tissue as well. Interest has been revived by the research of Beatriz G-T. Pogo, a professor in the departments of medicine and microbiology at Mount Sinai School of Medicine, in New York. Examining some 400 to 500 breast-cancer samples, she has found DNA sequences resembling MMTV that are not present in normal tissue or in other human cancers. She remains guarded about the implications.

Can You "Catch" Schizophrenia?

Microbes obviously can cause mental disorders -- as syphilitic dementia, to name but one example, makes brutally clear. But most post-Freudian discussions of psychiatric dysfunction have tended not to invoke infection. Recently, however, some cases of childhood obsessive compulsive disorder (OCD) have hinted at a new set of possibilities. Children who have this disease may compulsively count the crayons in their book bags over and over again, or meticulously avoid each crack in the pavement, in order to ward off some imagined evil. Susan E. Swedo, of the National Institute of Mental Health, in Bethesda, Maryland, noticed strong resemblances between OCD and a disease called Sydenham's chorea, formerly known as Saint Vitus's dance, which, like rheumatic heart disease, is a rare complication of an untreated streptococcal infection. Streptococcal antibodies find their way into the brain and attack a region called the basal ganglia, causing characteristic clumsiness and arm-flapping movements along with obsessions, compulsions, senseless rituals, and *idées fixes*. Could some cases of childhood OCD be a milder version of this illness? The hunch paid off. In the early 1990s a new syndrome, known as PANDAS (pediatric autoimmune neuropsychiatric disorders associated with streptococcus), was recognized.

Some children with OCD get better when they are given intravenous immunoglobulin or undergo therapeutic plasma exchange to remove the antibodies from their blood. It is not known whether adult-onset OCD -- whose most famous avatar was the germ-phobic Howard Hughes -- also results from some sort of infection. But it is certainly provocative that a mental disorder can result from a lingering immune response. The phenomenon makes some people wonder about schizophrenia.

For years, amid the smorgasbord of theories about the etiology of schizophrenia, there has been recurring speculation about a schizophrenia virus. Karl Menninger wondered in the 1920s

if schizophrenia might result from a flu infection. Later researchers pointed to data that showed seasonal and geographic patterns in the births of schizophrenics, suggestive of infection -- though it must be said that the viral theorists were largely regarded as inhabiting the fringe. Genetic theories grabbed center stage, and by the 1990s most researchers were pinning their hopes on the genetic markers being identified in the Human Genome Project.

In Ewald and Cochran's view, evolutionary laws dictate that infection must be a factor in schizophrenia. "They announced they had the gene for schizophrenia, and then it turned out not to be true," Cochran said one day when I mentioned genetic markers. "I think they found and unfound the gene for depression about six times. Nobody's found a gene yet for any common mental illness. Maybe instead of the Human Genome Project we should have the Human Germ Project." Cochran is endorsing a suggestion made by several scientists in a recent issue of *Nature.* "I don't mean to say that the Human Genome Project isn't worthwhile for many reasons, but all the genes we've found have been for *rare* diseases. I don't think the common diseases are going to turn out that way."

Schizophrenia affects about one percent of the population, and thus in Ewald and Cochran's scheme is too common for a genetic disease that profoundly impairs fitness. As noted, the background mutation rate -- the ratate which a gene spontaneously mutates -- is typically about one in 50,000 to one in 100,000. Not surprisingly, genetic diseases that are severely fitness-impairing (for example, achondroplastic dwarfism) tend to have roughly the same odds, depending on the gene. (In a few cases, however, the gene involved may be especially error-prone, resulting in a higher frequency of mishaps. One of the most common genetic diseases, Duchenne's muscular dystrophy, afflicts boys at a rate of one in 7,000, reflecting the fragility of an uncommonly long gene.)

From the fitness perspective, schizophrenia is a catastrophe. It is estimated that male schizophrenics have roughly half as many offspring as the general population has. Female schizophrenics have roughly 75 percent as many. Schizophrenia should therefore approach the level of a random mutation after many generations. (To explain this away, some genetic theorists have proposed that in hunter-gatherer cultures schizophrenics were the tribal shamans -- desirable as sexual partners -- and thus did not incur a reproductive disadvantage.)

No one has found a schizophrenia virus yet, but some think they may be close. Following a tip from Ewald and Cochran, I typed "Borna virus" into my online search engine and ended up with a stack of scientific papers. Borna virus was first recognized as the cause of a neurologic disease in horses, and can infect nearly all warm-blooded animals, from birds to primates. Horses and other animals infected with Borna virus may exhibit depressed or apathetic behavior, weakness of the legs, abnormal body postures, or a staggering gait. Borna-infected laboratory rats

exhibit learning disorders, exaggerated startle responses, and hyperactivity, among other things.

Royce Waltrip, an associate professor of psychiatry at the University of Mississippi with an expertise in virology, studies Borna virus. Despite being leery of a rash of inconsistent studies associating Borna virus with schizophrenia, Waltrip believes that "there is something there, though I don't know if it's a perinatal infection or an adult infection or what." When he started looking for antibodies to Borna in mental patients, he found that 14 percent of the schizophrenic patients had antibodies to two or three Borna proteins, whereas none of the healthy controls did. Waltrip speculates that Borna virus is not *the* cause of schizophrenia. "I think that schizophrenia is an etiologically heterogeneous disease," he said. "I think there are a finite number of ways the brain can respond to injury. There are probably different routes to schizophrenia, and there is probably more than one infectious pathway." One route, he hypothesizes, is Borna virus.

Ewald and Cochran do not doubt that multiple pathogens or multiple factors may be implicated in some broad disease syndromes, among them schizophrenia. But they worry, in general, that the "multifactorial"argument has become too facile a response. "That's what they *always* say when they don't know the cause of a disease," Cochran said on the phone. "They say it's *multifactorial.* Ulcers and heart disease were supposed to be multifactorial. But they're infections! Tuberculosis was supposed to be multifactorial. It's an infection!"

I happened to be visiting Ewald in his office when Cochran called, so we were having a three-way conversation, with Cochran's voice echoing over the static on a speaker phone. Outside the window the scene was shifting subtly into mid-autumn. Patches of orange and rust speckled the blue-green flanks of the Holyoke hills, and the students on the playing fields were wearing sweatpants.

But what about random accidents in utero as a cause of schizophrenia? I asked. Some kind of damage to the wiring?

"You'd have to say what caused the damage," Ewald responded, pointing out that the word "random" is often used to refer to something we haven't been able to understand. He noted once again how widespread schizophrenia is. "At this frequency -- one percent of the population -- we'd expect that natural selection would have led to protective mechanisms."

The same holds true for severe depression, Ewald believes. A tendency toward suicide doesn't make evolutionary sense in a world of organisms driven by the twin urgencies of survival and reproduction. The relentless engine of natural selection should have eliminated any genes that infringed on them. So why are these fitness-antagonistic traits still around?

This leads to a subject that Ewald is not shy about bringing up in discussions with colleagues and in

professional lectures: homosexuality. Various pieces of evidence have been adduced in recent years, by prominent researchers, for some sort of genetic component to homosexuality. The question arises as to whether natural selection would sustain a homosexual trait in the gene pool for any length of time. The best estimates of the fitness cost of homosexuality hover around 80 percent: in other words, gay men (in modern times, at least) have only 20 percent as many offspring as heterosexuals have. Simple math shows how quickly an evolutionarily disadvantageous trait like this should dwindle, if it is a simple genetic phenomenon. The researchers Richard Pillard, at the Boston University School of Medicine, and Dean Hamer, at the National Cancer Institute, are not persuaded that natural selection would necessarily have eliminated a homosexual trait, and offer ingenious counterarguments. (And they note that historically the fitness cost may not have been very high, when gay men stayed in the closet, married, and had children.)

No one, of course, has ever isolated a bacterium or a virus responsible for sexual orientation, and speculations about the manner in which such an agent would be transmitted can be nothing more than that. But Ewald and Cochran contend that the severe "fitness hit" of homosexuality is a red flag that should not be ignored, and that an infectious process should at least be explored. "It's a very sensitive subject,"Ewald admits, "and I don't want to be accused of gay-bashing. But I think the idea is viable. What scientists are supposed to do is evaluate an idea on the soundness of the logic and the testing of the predictions it can generate."

The Search for Telltale Signs

After I had spent time talking to Ewald and Cochran and reading back issues of the journal *Emerging Infectious Diseases*, everything began to look infectious to me. The catalogue of suspected chronic diseases caused by infection, according to David A. Relman, an assistant professor of medicine, microbiology, and immunology at Stanford University, now includes "sarcoidosis, various forms of inflammatory bowel disease, rheumatoid arthritis, systemic lupus erythematosus, Wegener's granulomatosis, diabetes mellitus, primary biliary cirrhosis, tropical sprue, and Kawasaki disease." Ewald and Cochran's list of likely suspects would include all of the above plus many forms of heart disease, arteriosclerosis, Alzheimer's disease, many if not most forms of cancer, multiple sclerosis, most major psychiatric diseases, Hashimoto's thyroiditis, cerebral palsy, polycystic ovary disease, and perhaps obesity and certain eating disorders. From an evolutionary perspective, Cochran says, anorexia is strikingly inimical to the survival principle. "I mean, *not to eat* -- what would cause that?"

"In all these situations you look for little signs of infectious spread," Ewald said in his office. "Is there geographic variation? Temporal variation? Does it go up or down across decades? Multiple sclerosis seems pretty clearly infectious, because you have these island populations where there was

no MS and then you see it spread like a wave through the population. And you have this latitudinal gradient ... "

"Yes!" Cochran burst from the speaker phone. "The farther you get from the Equator, the more common it is. It's three to four times more common if you grow up in Ontario than if you grow up in Mississippi. Some people have tried to say that's because Canadians are genetically different from Americans."

I downloaded a paper about extremely high rates of multiple sclerosis in the Shetland and Orkney Islands and other regions of Scotland, and I made a mental note of the many Canadian Web sites devoted to MS. Like other autoimmune diseases, MS looks suspiciously infectious for a number of reasons: epidemiological evidence of childhood exposure to disease agents, geographic clusters, abnormal immune responses to a variety of viruses, resemblances to animal models and human diseases with a relapsing-remitting course. And, in fact, a virus has been nominated: the human herpes virus 6, the agent of roseola infantum, a very mild disease of childhood. The connection, however, is by no means proved.

"No doubt everywhere people look there will be more and more examples of chronic diseases with infectious etiology," says Stephen S. Morse, an expert in infectious diseases at the Columbia University School of Public Health. "*Helicobacter* is probably the tip of the iceberg." Although we have wielded the tools of microbial cultivation for a hundred years, much of the microbial world is still as mysterious as an alien planet. "It has been estimated that only 0.4 percent of all extant bacterial species have been identified," David Relman has written. "Does this remarkable lack of knowledge pertain to the subset of microorganisms both capable of and accomplished in causing human disease?" Even the germs that inhabit our bodies -- the so-called "human commensal flora," such as the swarming populations of organisms that live in the spaces between our teeth -- are largely unknown, he points out. Most of them are presumably benign, up to a point. There are disquieting suggestions in the literature of a link between bacteria in dental plaque and coronary disease.

"Some people think it's scary to have these time bombs in our bodies," Ewald says, "but it's also encouraging -- because if it's a disease organism, then there's probably something we can do about it. The textbooks say, In 1900 most people died of infectious diseases, and today most people don't die of infectious disease; they die of cancer and heart disease and Alzheimer's and all these things. Well, in ten years I think the textbooks will have to be rewritten to say, "Throughout history most people have died of infectious disease, and most people continue to die of infectious disease."

Judith Hooper's essay, "A New Germ Theory," originally appeared in *The Atlantic Monthly* (February 1999): 41-53.

Return of the Natives: Playing God in the Fields

Kirk Johnson

The mugwort sounds like a villain from a Harry Potter novel, or the name of some plug-ugly in a bad 1930's prison movie. It's not a pretty plant, nor, by plant standards, is it very nice. To reproduce, it's quite capable of giving less aggressive flora an elbow in the eye and a shove toward extinction. The mugwort's a survivor.

The persimmon, on the other hand, is every botanist's dream -- a civilized and lovely tree that propagates at a leisurely pace, doesn't push out other species and produces a fine-scented blossom. Resplendent with its orange fruit and black bark, the persimmon has become quite rare.

Now the test: Which one is the real New Yorker? Is it: A) the take-no-prisoners mugwort, which evolved in Europe but has thrived in various forms in America, and particularly in New York City, where it loves poor soil full of limestone-laden concrete debris; or B) the retiring and reticent persimmon, which has been around since colonial days, but has seeds so delicate that they must spend a season in the soil before undertaking the rigors of germination?

It's a dichotomy and a tension as old as the city itself: on one side, a raw ambition to conquer new worlds; on the other, a hallowed lineage and all the right connections. This time around, the arena is a small patch of ground in Marine Park, Brooklyn, where late last month, workers from the New York City Parks Department were digging out a field of mugwort and other so-called invasives, to plant a garden full of old natives, including persimmon, that once thrived on the land that became New York City, but that mostly now do not.

Parks officials say the return-of-the-natives program, called Project X, is, of course, not intended as any kind of commentary on the city's cultural heritage, or on immigration, or on the tendency of old blood to thin out over time. Sometimes a plant is just a plant.

In many other places around the nation where so-called ecological restoration efforts are under way -- like the Midwest, where environmental groups and government agencies are re-establishing patches of native prairie grasses -- dipping into the old gene pool is also fairly simple, just a matter of replanting or encouraging a return to some more natural state.

But New York City has no natural state. Built over, upon and through, New York is a hybridized, cultivated hothouse of a city where the past has mostly been treated as a doormat -- something to be stepped on to make way for the future -- and where the triumphantly scrapping newcomer has been enshrined and celebrated as nowhere else. Doing ecological restoration in New York requires not just a return to some vestigial state, but a huge leap back to a time and place that many people say has been irretrievably lost under the tumult of history.

"Some people might accuse us of playing God," said the city's parks

commissioner, Henry J. Stern, who created Project X in 1997 and named it for an obscure Matthew Broderick movie in which laboratory chimpanzees escape back into the wild. But Mr. Stern says that's fine by him -- the city plays God all the time when it comes to nature.

Since at least the days when Frederick Law Olmsted threw out most of what grew wild in Central Park and replaced it with his vision of what a cultivated urban oasis should be, the definition of "natural" in New York City has been a purely social construct, Mr. Stern said -- an invention of the people who lived here.

"The New York City parks system is not a Darwinian jungle in which species fight to the death," he said. "We intervene all the time to do the things that we consider socially useful and appropriate."

The goal of Project X, Parks Department officials say, is conservation and biodiversity, for human residents to appreciate, and to provide a broader habitat for the birds and animals that depend on the city's plants for food. Reaching back into the pre-European-settlement past, park officials say, is simply the best stock to draw from, because once upon a time, however remote it might now seem, these species did flourish here, and they might yet again.

But the altered environment of New York today, from air quality to climate, is only one problem. Another is the question of which past to draw from. For generations, one of the key threads of American history, especially for environmentalists, was the idea of a stable state -- that nature was in equilibrium before Europeans came, and was then thrown out of balance by exploitative newcomers who didn't know how to live in harmony with the land.

A phalanx of geographers, historians and anthropologists has now mostly trashed that notion. The core of the new view is that in nature, constant change is the stable state. If you reach back, there's really no "there" there, the revisionists say, only another flowing river of ecological niches and habitats that flourish for a while and then don't. The past, in other words, is not that different from the present.

"What's problematic about 'native' as a word is that it assumes that there is a moment in history we can fix that was stable and benign and anything since then should be reversed," said William Cronon, a professor of history, geography and environmental studies at the University of Wisconsin at Madison who has been a sharp critic of the methodology behind many restoration efforts. "That's much too crude a picture of how history happens."

Nostalgia for the old, undisturbed wilderness has also been a recurring theme of the environmental movement, but many academics say that nostalgia has been based on a myth. Beginning in the mid-1800's, a worship of the wilderness led by Emerson, Thoreau and the painters of the Hudson River School was based on observation: vast tracts of the continent were empty and open and seemingly pure of taint in the years before the Civil War.

Ecologists like Professor Cronon and William M. Denevan, a geographer and the author of a famous essay in the early 1990's called "The Pristine Myth," argue that that old wilderness was an illusion. American Indian life, the new evidence suggests, had more impact on the landscape and nature than the romanticists could know.

"The Native American landscape of the early 16th century was humanized almost everywhere," Mr. Denevan wrote. "Populations were large. Forest composition had been modified, grasslands had been created, wildlife disrupted, and erosion was severe in places."

But three centuries later, by the time the early naturalists began singing the praises of the primeval, most of the Indians were gone, decimated by European diseases. The land was in recovery from earlier depredations and only looked natural.

Some researchers are even coming full circle in their thinking about the biological invaders in New York. A reedlike plant called phragmites, for example, which likes brackish, swampy soil, was once seen as a relentless threat that would take over wetland areas. While that is indeed happening, biologists say they are now finding that phragmites also has some pretty decent qualities, including a deep root system that tends to flush out pollutants from the soil.

And for some invaders, time simply seems to be catching up. The ailanthus, for example, a spiny-leafed tree of Asian descent made famous in the book "A Tree Grows in Brooklyn," has the reputation of being able to grow in desolate concrete cracks where nothing else can flourish. Once perceived by the city as an exotic invader that should be rooted out, the ailanthus is now under attack by nature itself -- parasites and fungi have infected thousands of trees in recent years. Maybe in time it will become a symbol of old New York, too, by virtue of needing the city's help to keep going.

Kirk Johnson's article, "Return of the Natives: Playing God in the Fields," first appeared in *The New York Times Metro* (Sunday, November 12, 2000): 37 and 42.

Breaking the Global Warming Gridlock

Daniel Sarewitz and Roger Pielke Jr.

"Both sides on the issue of greenhouse gases frame their arguments in terms of science, but each new scientific finding only raises new questions -- dooming the debate to be a pointless spiral. It's time, the authors argue, for a radically new approach: if we took practical steps to reduce our vulnerability to today's weather, we would go a long way toward solving the problem of tomorrow's climate."

In the last week of October, 1998, Hurricane Mitch stalled over Central America, dumping between three and six feet of rain within forty-eight hours, killing more than 10,000 people in landslides and floods, triggering a cholera epidemic, and virtually wiping out the economies of Honduras and Nicaragua. Several days later some 1,500 delegates, accompanied by thousands of advocates and media representatives, met in Buenos Aires at the fourth Conference of the Parties to the United Nations Framework Convention on Climate Change. Many at the conference pointed to Hurricane Mitch as a harbinger of the catastrophes that await us if we do not act immediately to reduce emissions of carbon dioxide and other so-called greenhouse gases. The delegates passed a resolution of "solidarity with Central America" in which they expressed concern "that global warming may be contributing to the worsening of weather" and urged "governments, ... and society in general, to continue their efforts to find permanent solutions to the factors which cause or may cause climate events." Children wandering bereft in the streets of Tegucigalpa became unwitting symbols of global warming.

But if Hurricane Mitch was a public-relations gift to environmentalists, it was also a stark demonstration of the failure of our current approach to protecting the environment. Disasters like Mitch are a present and historical reality, and they will become more common and more deadly regardless of global warming. Underlying the havoc in Central America were poverty, poor land-use practices, a degraded local environment, and inadequate emergency preparedness -- conditions that will not be alleviated by reducing greenhouse-gas emissions.

At the heart of this dispiriting state of affairs is a vitriolic debate between those who advocate action to reduce global warming and those who oppose it. The controversy is informed by strong scientific evidence that the earth's surface has warmed over the past century. But the controversy, and the science, focus on the wrong issues, and distract attention from what needs to be done. The enormous scientific, political, and financial resources now aimed at the problem of global warming create the perfect conditions for international and domestic political gridlock, but they can have little effect on the root causes of global environmental degradation, or on the human suffering that so often accompanies it. Our goal is to move

beyond the gridlock and stake out some common ground for political dialogue and effective action.

Framing the Issue

In politics everything depends on how an issue is framed: the terms of debate, the allocation of power and resources, the potential courses of action. The issue of global warming has been framed by a single question: Does the carbon dioxide emitted by industrialized societies threaten the earth's climate? On one side are the doomsayers, who foretell environmental disaster unless carbon-dioxide emissions are immediately reduced. On the other side are the cornucopians, who blindly insist that society can continue to pump billions of tons of greenhouse gases into the atmosphere with no ill effect, and that any effort to reduce emissions will stall the engines of industrialism that protect us from a Hobbesian wilderness. From our perspective, each group is operating within a frame that has little to do with the practical problem of how to protect the global environment in a world of six billion people (and counting). To understand why global-warming policy is a comprehensive and dangerous failure, therefore, we must begin with a look at how the issue came to be framed in this way. Two converging trends are implicated: the evolution of scientific research on the earth's climate, and the maturation of the modern environmental movement.

Since the beginning of the Industrial Revolution the combustion of fossil fuels -- coal, oil, natural gas -- has powered economic growth and also emitted great quantities of carbon dioxide and other greenhouse gases. More than a century ago the Swedish chemist Svante Arrhenius and the American geologist T. C. Chamberlin independently recognized that industrialization could lead to rising levels of carbon dioxide in the atmosphere, which might in turn raise the atmosphere's temperature by trapping solar radiation that would otherwise be reflected back into space -- a "greenhouse effect" gone out of control. In the late 1950s the geophysicist Roger Revelle, arguing that the world was making itself the subject of a giant "geophysical experiment," worked to establish permanent stations for monitoring carbon-dioxide levels in the atmosphere. Monitoring documented what theory had predicted: atmospheric carbon dioxide was increasing.

In the United States the first high-level government mention of global warming was buried deep within a 1965 White House report on the nation's environmental problems. Throughout the 1960s and 1970s global warming -- at that time typically referred to as "inadvertent modification of the atmosphere," and today embraced by the term "climate change" -- remained an intriguing hypothesis that caught the attention of a few scientists but generated little concern among the public or environmentalists. Indeed, some climate researchers saw evidence for global cooling and a future ice age. In any case, the threat of nuclear war was sufficiently urgent, plausible, and horrific to crowd global warming off the catastrophe agenda.

Continued research, however, fortified the theory that fossil-fuel combustion could contribute to global warming. In 1977 the nonpartisan National Academy of Sciences issued a study called *Energy and Climate,* which carefully suggested that the possibility of global warming "should lead neither to panic nor to complacency." Rather, the study continued, it should "engender a lively sense of urgency in getting on with the work of illuminating the issues that have been identified and resolving the scientific uncertainties that remain." As is typical with National Academy studies, the primary recommendation was for more research.

In the early 1980s the carbon-dioxide problem received its first sustained attention in Congress, in the form of hearings organized by Representative Al Gore, who had become concerned about global warming when he took a college course with Roger Revelle, twelve years earlier. In 1983 the Environmental Protection Agency released a report detailing some of the possible threats posed by the anthropogenic, or human-caused, emission of carbon dioxide, but the Reagan Administration decisively downplayed the document. Two years later a prestigious international scientific conference in Villach, Austria, concluded that climate change deserved the attention of policymakers worldwide. The following year, at a Senate fact-finding hearing stimulated by the conference, Robert Watson, a climate scientist at NASA, testified, "Global warming is inevitable. It is only a question of the magnitude and the timing."

At that point global warming was only beginning to insinuate itself into the public consciousness. The defining event came in June of 1988, when another NASA climate scientist, James Hansen, told Congress with "ninety-nine percent confidence" that "the greenhouse effect has been detected, and it is changing our climate now." Hansen's proclamation made the front pages of major newspapers, ignited a firestorm of public debate, and elevated the carbon-dioxide problem to pre-eminence on the environmental agenda, where it remains to this day. Nothing had so galvanized the environmental community since the original Earth Day, eighteen years before.

Historically, the conservation and environmental movements have been rooted in values that celebrate the intrinsic worth of unspoiled landscape and propagate the idea that the human spirit is sustained through communion with nature. More than fifty years ago Aldo Leopold, perhaps the most important environmental voice of the twentieth century, wrote, "We face the question whether a still higher 'standard of living' is worth its cost in things natural, wild, and free. For us of the minority, ... the chance to find a pasque-flower is a right as inalienable as free speech." But when global warming appeared, environmentalists thought they had found a justification better than inalienable rights -- they had found facts and rationality, and they fell head over heels in love with science.

Of course, modern environmentalists were already in the habit of calling on science to help

advance their agenda. In 1967, for example, the Environmental Defense Fund was founded with the aim of using science to support environmental protection through litigation. But global warming was, and is, different. It exists as an environmental issue only because of science. People can't directly sense global warming, the way they can see a clear-cut forest or feel the sting of urban smog in their throats. It is not a discrete event, like an oil spill or a nuclear accident. Global warming is so abstract that scientists argue over how they would know if they actually observed it. Scientists go to great lengths to measure and derive something called the "global average temperature" at the earth's surface, and the total rise in this temperature over the past century -- an increase of about six tenths of a degree Celsius as of 1998 -- does suggest warming. But people and ecosystems experience local and regional temperatures, not the global average. Furthermore, most of the possible effects of global warming are not apparent in the present; rather, scientists predict that they will occur decades or even centuries hence. Nor is it likely that scientists will ever be able to attribute any isolated event -- a hurricane, a heat wave -- to global warming.

A central tenet of environmentalism is that less human interference in nature is better than more. The imagination of the environmental community was ignited not by the observation that greenhouse-gas concentrations were increasing but by the scientific conclusion that the increase was caused by human beings. The Environmental Defense Fund, perhaps because of its explicitly scientific bent, was one of the first advocacy groups to make this connection. As early as 1984 its senior scientist, Michael Oppenheimer, wrote on the op-ed page of *The New York Times,*

> With unusual unanimity, scientists testified at a recent Senate hearing that using the atmosphere as a garbage dump is about to catch up with us on a global scale.... Carbon dioxide emissions from fossil fuel combustion and other "greenhouse" gases are throwing a blanket over the Earth.... The sea level will rise as land ice melts and the ocean expands. Beaches will erode while wetlands will largely disappear.... Imagine life in a sweltering, smoggy New York without Long Island's beaches and you have glimpsed the world left to future generations.

Preserving tropical jungles and wetlands, protecting air and water quality, slowing global population growth -- goals that had all been justified for independent reasons, often by independent organizations -- could now be linked to a single fact, anthropogenic carbon-dioxide emissions, and advanced along a single political front, the effort to reduce those emissions. Protecting forests, for example, could help fight global warming because forests act as "sinks" that absorb carbon dioxide. Air pollution could be addressed in part by promoting the same clean-energy sources that would reduce carbon-dioxide emissions. Population growth needed to be controlled in order to reduce demand for fossil-fuel

combustion. And the environmental community could reinvigorate its energy-conservation agenda, which had flagged since the early 1980s, when the effects of the second Arab oil shock wore off. Senator Timothy Wirth, of Colorado, spelled out the strategy in 1988: "What we've got to do in energy conservation is try to ride the global warming issue. Even if the theory of global warming is wrong, to have approached global warming as if it is real means energy conservation, so we will be doing the right thing anyway in terms of economic policy and environmental policy." A broad array of environmental groups and think tanks, including the Environmental Defense Fund, the Sierra Club, Greenpeace, the World Resources Institute, and the Union of Concerned Scientists, made reductions in carbon-dioxide emissions central to their agendas.

The moral problem seemed clear: human beings were causing the increase of carbon dioxide in the atmosphere. But the moral problem existed only because of a scientific fact -- a fact that not only provided justification for doing many of the things that environmentalists wanted to do anyway but also dictated the overriding course of action: reduce carbon-dioxide emissions. Thus science was used to rationalize the moral imperative, unify the environmental agenda, and determine the political solution.

Research as Policy

The summer of 1988 was stultifyingly hot even by Washington, D.C., standards, and the Mississippi River basin was suffering a catastrophic drought. Hansen's proclamation that the greenhouse effect was "changing our climate now" generated a level of public concern sufficient to catch the attention of many politicians. George Bush, who promised to be "the environmental President" and to counter "the greenhouse effect with the White House effect," was elected that November. Despite his campaign rhetoric, the new President was unprepared to offer policies that would curtail fossil-fuel production and consumption or impose economic costs for uncertain political gains. Bush's advisers recognized that support for scientific research offered the best solution politically, because it would give the appearance of action with minimal political risk.

With little debate the Republican Administration and the Democratic Congress in 1990 created the U.S. Global Change Research Program. The program's annual budget reached $1 billion in 1991 and $1.8 billion in 1995, making it one of the largest science initiatives ever undertaken by the U.S. government. Its goal, according to Bush Administration documents, was "to establish the scientific basis for national and international policymaking related to natural and human-induced changes in the global Earth system." A central scientific objective was to "support national and international policymaking by developing the ability to predict the nature and consequences of changes in the Earth system, particularly climate change." A decade and more than $16 billion later, scientific research remains

the principal U.S. policy response to climate change.

Meanwhile, the marriage of environmentalism and science gave forth issue: diplomatic efforts to craft a global strategy to reduce carbon-dioxide emissions. Scientists, environmentalists, and government officials, in an attempt to replicate the apparently successful international response to stratospheric-ozone depletion that was mounted in the mid-1980s, created an institutional structure aimed at formalizing the connection between science and political action. The Intergovernmental Panel on Climate Change was established through the United Nations, to provide snapshots of the evolving state of scientific understanding. The IPCC issued major assessments in 1990 and 1996; a third is due early next year. These assessments provide the basis for action under a complementary mechanism, the United Nations Framework Convention on Climate Change. Signed by 154 nations at the 1992 "Earth Summit" in Rio de Janeiro, the convention calls for voluntary reductions in carbon-dioxide emissions. It came into force as an international treaty in March of 1994, and has been ratified by 181 nations. Signatories continue to meet in periodic Conferences of the Parties, of which the most significant to date occurred in Kyoto in 1997, when binding emissions reductions for industrialized countries were proposed under an agreement called the Kyoto Protocol.

The IPCC defines climate change as any sort of change in the earth's climate, no matter what the cause. But the Framework Convention restricts its definition to changes that result from the anthropogenic emission of greenhouse gases. This restriction has profound implications for the framing of the issue. It makes all action under the convention hostage to the ability of scientists not just to document global warming but to attribute it to human causes. An apparently simple question, Are we causing global warming or aren't we?, has become the obsessional focus of science -- and of policy.

Finally, if the reduction of carbon-dioxide emissions is an organizing principle for environmentalists, scientists, and environmental-policy makers, it is also an organizing principle for all those whose interests might be threatened by such a reduction. It's easy to be glib about who they might be -- greedy oil and coal companies, the rapacious logging industry, recalcitrant automobile manufacturers, corrupt foreign dictatorships -- and easy as well to document the excesses and absurdities propagated by some representatives of these groups. Consider, for example, the Greening Earth Society, which "promotes the optimistic scientific view that CO2 is beneficial to humankind and all of nature," and happens to be funded by a coalition of coal-burning utility companies. One of the society's 1999 press releases reported that "there will only be sufficient food for the world's projected population in 2050 if atmospheric concentrations of carbon dioxide are permitted to increase, unchecked." Of course, neither side of the debate has a lock on excess or distortion. The point is simply that the climate-change problem has been framed

in a way that catalyzes a determined and powerful opposition.

The Problem With Predictions

When anthropogenic carbon-dioxide emissions became the defining fact for global environmentalism, scientific uncertainty about the causes and consequences of global warming emerged as the apparent central obstacle to action. As we have seen, the Bush Administration justified its huge climate-research initiative explicitly in terms of the need to reduce uncertainty before taking action. Al Gore, by then a senator, agreed, explaining that "more research and better research and better targeted research is absolutely essential if we are going to eliminate the remaining areas of uncertainty and build the broader and stronger political consensus necessary for the unprecedented actions required to address this problem." Thus did a Republican Administration and a Democratic Congress -- one side looking for reasons to do nothing, the other seeking justification for action -- converge on the need for more research.

How certain do we need to be before we take action? The answer depends, of course, on where our interests lie. Environmentalists can tolerate a good deal more uncertainty on this issue than can, say, the executives of utility or automobile companies. Science is unlikely to overcome such a divergence in interests. After all, science is not a fact or even a set of facts; rather, it is a process of inquiry that generates more questions than answers. The rise in anthropogenic greenhouse-gas emissions, once it was scientifically established, simply pointed to other questions. How rapidly might carbon-dioxide levels rise in the future? How might climate respond to this rise? What might be the effects of that response? Such questions are inestimably complex, their answers infinitely contestable and always uncertain, their implications for human action highly dependent on values and interests.

Having wedded themselves to science, environmentalists must now cleave to it through thick and thin. When research results do not support their cause, or are simply uncertain, they cannot resort to values-based arguments, because their political opponents can portray such arguments as an opportunistic abandonment of rationality. Environmentalists have tried to get out of this bind by invoking the "precautionary principle" -- a dandified version of "better safe than sorry" -- to advance the idea that action in the presence of uncertainty is justified if potential harm is great. Thus uncertainty itself becomes an argument for action. But nothing is gained by this tactic either, because just as attitudes toward uncertainty are rooted in individual values and interests, so are attitudes toward potential harm.

Charged by the Framework Convention to search for proof of harm, scientists have turned to computer models of the atmosphere and the oceans, called general circulation models, or GCMs. Carbon-dioxide levels and atmospheric temperatures are measures of the physical state of the atmosphere. GCMs, in contrast, are mathematical representations that

scientists use to try to understand past climate conditions and predict future ones. With GCMs scientists seek to explore how climate might respond under different influences -- for example, different rates of carbon-dioxide increase. GCMs have calculated global average temperatures for the past century that closely match actual surface-temperature records; this gives climate modelers some confidence that they understand how climate behaves.

Computer models are a bit like Aladdin's lamp -- what comes out is very seductive, but few are privy to what goes on inside. Even the most complex models, however, have one crucial quality that non-experts can easily understand: their accuracy can be fully evaluated only after seeing what happens in the real world over time. In other words, predictions of how climate will behave in the future cannot be proved accurate today. There are other fundamental problems with relying on GCMs. The ability of many models to reproduce temperature records may in part reflect the fact that the scientists who designed them already "knew the answer." As John Firor, a former director of the National Center for Atmospheric Research, has observed, climate models "are made by humans who tend to shape or use their models in ways that mirror their own notion of what a desirable outcome would be." Although various models can reproduce past temperature records, and yield similar predictions of future temperatures, they are unable to replicate other observed aspects of climate, such as cloud behavior and atmospheric temperature, and they diverge widely in predicting specific regional climate phenomena, such as precipitation and the frequency of extreme weather events. Moreover, it is simply not possible to know far in advance if the models agree on future temperature because they are similarly right or similarly wrong.

In spite of such pitfalls, a fundamental assumption of both U.S. climate policy and the UN Framework Convention is that increasingly sophisticated models, run on faster computers and supported by more data, will yield predictions that can resolve political disputes and guide action. The promise of better predictions is irresistible to champions of carbon-dioxide reduction, who, after all, must base their advocacy on the claim that anthropogenic greenhouse-gas emissions will be harmful in the future. But regardless of the sophistication of such predictions, new findings will almost inevitably be accompanied by new uncertainties -- that's the nature of science -- and may therefore act to fuel, rather than to quench, political debate. Our own prediction is that increasingly complex mathematical models that delve ever more deeply into the intricacies and the uncertainties of climate will only hinder political action.

An example of how more scientific research fuels political debate came in 1998, when a group of prominent researchers released the results of a model analyzing carbon-dioxide absorption in North America. Their controversial findings, published in the prestigious journal Science, suggested that the amount of carbon dioxide absorbed by U.S. forests might

be greater than the amount emitted by the nation's fossil-fuel combustion. This conclusion has two astonishing implications. First, the United States -- the world's most profligate energy consumer -- may not be directly contributing to rising atmospheric levels of carbon dioxide. Second, the atmosphere seems to be benefiting from young forests in the eastern United States that are particularly efficient at absorbing carbon dioxide. But these young forests exist only because old-growth forests were clear-cut in the eighteenth and nineteenth centuries to make way for farms that were later abandoned in favor of larger, more efficient midwestern farms. In other words, the possibility that the United States is a net carbon-dioxide sink does not reflect efforts to protect the environment; on the contrary, it reflects a history of deforestation and development.

Needless to say, these results quickly made their way into the political arena. At a hearing of the House Resources Committee, Representative John E. Peterson, of Pennsylvania, a Republican, asserted, "There are recent studies that show that in the Northeast, where we have continued to cut timber, and have a regenerating, younger forest, that the greenhouse gases are less when they leave the forest.... So a young, growing, vibrant forest is a whole lot better for clean air than an old dying forest." George Frampton, the director of the White House Council on Environmental Quality, countered, "The science on this needs a lot of work.... we need more money for scientific research to undergird that point of view." How quickly the tables can turn: here was a conservative politician wielding (albeit with limited coherence) the latest scientific results to justify logging old-growth forests in the name of battling global warming, while a Clinton Administration official backpedaled in the manner more typically adopted by opponents of action on climate change -- invoking the need for more research.

That's a problem with science -- it can turn around and bite you. An even more surprising result has recently emerged from the study of Antarctic glaciers. A strong argument in favor of carbon-dioxide reduction has been the possibility that if temperatures rise owing to greenhouse-gas emissions, glaciers will melt, the sea level will rise, and populous coastal zones all over the world will be inundated. The West Antarctic Ice Sheet has been a subject of particular concern, both because of evidence that it is now retreating and because of geologic studies showing that it underwent catastrophic collapse at least once in the past million years or so. "Behind the reasoned scientific estimates," Greenpeace warns, "lies the possibility of ... the potential catastrophe of a six metre rise in sea level." But recent research from Antarctica shows that this ice sheet has been melting for thousands of years. Sea-level rise is a problem, but anthropogenic global warming is not the only culprit, and reducing emissions cannot be the only solution.

To make matters more difficult, some phenomena, especially those involving human behavior, are intrinsically unpredictable. Any

calculation of future anthropogenic global warming must include an estimate of rates of fossil-fuel combustion in the coming decades. This means that scientists must be able to predict not only the amounts of coal, oil, and natural gas that will be consumed but also changes in the mixture of fossil fuels and other energy sources, such as nuclear, hydro-electric, and solar. These predictions rest on interdependent factors that include energy policies and prices, rates of economic growth, patterns of industrialization and technological innovation, changes in population, and even wars and other geopolitical events. Scientists have no history of being able to predict any of these things. For example, their inability to issue accurate population projections is "one of the best-kept secrets of demography," according to Joel Cohen, the director of the Laboratory of Populations at Rockefeller University. "Most professional demographers no longer believe they can predict precisely the future growth rate, size, composition and spatial distribution of populations," Cohen has observed.

Predicting the human influence on climate also requires an understanding of how climate behaved "normally," before there was any such influence. But what are normal climate patterns? In the absence of human influence, how stationary is climate? To answer such questions, researchers must document and explain the behavior of the pre-industrial climate, and they must also determine how the climate would have behaved over the past two centuries had human beings not been changing the composition of the atmosphere.

However, despite the billions spent so far on climate research, Kevin Trenberth, a senior scientist at the National Center for Atmospheric Research, told the *Chicago Tribune* last year, "This may be a shock to many people who assume that we do know adequately what's going on with the climate, but we don't." The National Academy of Sciences reported last year that "deficiencies in the accuracy, quality, and continuity of the [climate] records ... place serious limitations on the confidence" of research results.

If the normal climate is non-stationary, then the task of identifying the human fingerprint in global climate change becomes immeasurably more difficult. And the idea of a naturally stationary climate may well be chimerical. Climate has changed often and dramatically in the recent past. In the 1940s and 1950s, for example, the East Coast was hammered by a spate of powerful hurricanes, whereas in the 1970s and 1980s hurricanes were much less common. What may appear to be "abnormal" hurricane activity in recent years is abnormal only in relation to this previous quiet period. As far as the ancient climate goes, paleoclimatologists have found evidence of rapid change, even over periods as short as several years. Numerous influences could account for these changes. Ash spewed high into the atmosphere by large volcanoes can reflect solar radiation back into space and result in short-term cooling, as occurred after the 1991 eruption of Mount Pinatubo. Variations in the energy emitted by the sun also affect climate, in ways that are not yet fully understood. Global ocean currents,

which move huge volumes of warm and cold water around the world and have a profound influence on climate, can speed up, slow down, and maybe even die out over very short periods of time -- perhaps less than a decade. Were the Gulf Stream to shut down, the climate of Great Britain could come to resemble that of Labrador.

Finally, human beings have been changing the surface of the earth for millennia. Scientists increasingly realize that deforestation, agriculture, irrigation, urbanization, and other human activities can lead to major changes in climate on a regional or perhaps even a global scale. Thomas Stohlgren, of the U.S. Geological Survey, has written, "The effects of land use practices on regional climate may overshadow larger-scale temperature changes commonly associated with observed increases in carbon dioxide." The idea that climate may constantly be changing for a variety of reasons does not itself undercut the possibility that anthropogenic carbon dioxide could seriously affect the global climate, but it does confound scientific efforts to predict the consequences of carbon-dioxide emissions.

The Other 80 Percent

If predicting how climate will change is difficult and uncertain, predicting how society will be affected by a changing climate -- especially at the local, regional, and national levels, where decision-making takes place -- is immeasurably more so. And predicting the impact on climate of reducing carbon-dioxide emissions is so uncertain as to be meaningless. What we do know about climate change suggests that there will be winners and losers, with some areas and nations potentially benefiting from, say, longer growing seasons or more rain, and others suffering from more flooding or drought. But politicians have no way to accurately calibrate the effects-human and economic -- of global warming, or the benefits of reducing carbon-dioxide emissions.

Imagine yourself a leading policymaker in a poor, overpopulated, undernourished nation with severe environmental problems. What would it take to get you worried about global warming? You would need to know not just that global warming would make the conditions in your country worse but also that any of the scarce resources you applied to reducing carbon-dioxide emissions would lead to more benefits than if they were applied in another area, such as industrial development or housing construction. Such knowledge is simply unavailable. But you do know that investing in industrial development or better housing would lead to concrete political, economic, and social benefits.

More specifically, suppose that many people in your country live in shacks on a river's floodplain. Floodplains are created and sustained by repeated flooding, so floods are certain to occur in the future, regardless of global warming. Given a choice between building new houses away from the floodplain and converting power plants from cheap local coal to costlier imported fuels, what would you do? New houses would ensure that lives and homes would be saved; a new power plant would reduce carbon-dioxide

emissions but leave people vulnerable to floods. In the developing world the carbon-dioxide problem pales alongside immediate environmental and developmental problems. *The China Daily* reported during the 1997 Kyoto Conference:

> The United States ... and other nations made the irresponsible demand ... that the developing countries should make commitments to limiting greenhouse gas emissions.... As a developing country, China has 60 million poverty-stricken people and China's per capita gas emissions are only one-seventh of the average amount of more developed countries. Ending poverty and developing the economy must still top the agenda of [the] Chinese government.

For the most part, the perspectives of those in the developing world -- about 80 percent of the planet's population -- have been left outside the frame of the climate-change discussion. This is hardly surprising, considering that the frame was defined mainly by environmentalists and scientists in affluent nations. Developing nations, meanwhile, have quite reasonably refused to agree to the targets for carbon-dioxide reduction set under the Kyoto Protocol. The result may feel like a moral victory to some environmentalists, who reason that industrialized countries, which caused the problem to begin with, should shoulder the primary responsibility for solving it. But the victory is hollow, because most future emissions increases will come from the developing world. In affluent nations almost everyone already owns a full complement of energy-consuming devices. Beyond a certain point increases in income do not result in proportional increases in energy consumption; people simply trade in the old model for a new and perhaps more efficient one. If present trends continue, emissions from the developing world are likely to exceed those from the industrialized nations within the next decade or so.

Twelve years after carbon dioxide became the central obsession of global environmental science and politics, we face the following two realities:

First, atmospheric carbon-dioxide levels will continue to increase. The Kyoto Protocol, which represents the world's best attempt to confront the issue, calls for industrialized nations to reduce their emissions below 1990 levels by the end of this decade. Political and technical realities suggest that not even this modest goal will be achieved. To date, although eighty-four nations have signed the Kyoto Protocol, only twenty-two nations -- half of them islands, and none of them major carbon-dioxide emitters -- have ratified it. The United States Senate, by a vote of 95-0 in July of 1997, indicated that it would not ratify any climate treaty that lacked provisions requiring developing nations to reduce their emissions. The only nations likely to achieve the emissions commitments set under Kyoto are those, like Russia and Ukraine, whose economies are in ruins. And even successful implementation of the treaty would not halt the progressive increase in global carbon-dioxide emissions.

Second, even if greenhouse-gas emissions could somehow be rolled back to pre-industrial levels, the impacts of climate on society and the environment would continue to increase. Climate affects the world not just through phenomena such as hurricanes and droughts but also because of societal and environmental vulnerability to such phenomena. The horrific toll of Hurricane Mitch reflected not an unprecedented climatic event but a level of exposure typical in developing countries where dense and rapidly increasing populations live in environmentally degraded conditions. Similar conditions underlay more-recent disasters in Venezuela and Mozambique.

If these observations are correct, and we believe they are essentially indisputable, then framing the problem of global warming in terms of carbon-dioxide reduction is a political, environmental, and social dead end. We are not suggesting that humanity can with impunity emit billions of tons of carbon dioxide into the atmosphere each year, or that reducing those emissions is not a good idea. Nor are we making the nihilistic point that since climate undergoes changes for a variety of reasons, there is no need to worry about additional changes imposed by human beings. Rather, we are arguing that environmentalists and scientists, in focusing their own, increasingly congruent interests on carbon-dioxide emissions, have framed the problem of global environmental protection in a way that can offer no realistic prospect of a solution.

Redrawing the Frame

Local weather is the day-to-day manifestation of global climate. Weather is what we experience, and lately there has been plenty to experience. In recent decades human, economic, and environmental losses from disasters related to weather have increased dramatically. Insurance-industry data show that insured losses from weather have been rising steadily. A 1999 study by the German firm Munich Reinsurance Company compared the 1960s with the 1990s and concluded that "the number of great natural catastrophes increased by a factor of three, with economic losses -- taking into account the effects of inflation -- increasing by a factor of more than eight and insured losses by a factor of no less than sixteen." And yet scientists have been unable to observe a global increase in the number or the severity of extreme weather events. In 1996 the IPCC concluded, "There is no evidence that extreme weather events, or climate variability, has increased, in a global sense, through the 20th century, although data and analyses are poor and not comprehensive."

What has unequivocally increased is society's vulnerability to weather. At the beginning of the twentieth century the earth's population was about 1.6 billion people; today it is about six billion people. Almost four times as many people are exposed to weather today as were a century ago. And this increase has, of course, been accompanied by enormous increases in economic activity, development, infrastructure, and interdependence. In the past fifty years, for example,

Florida's population rose fivefold; 80 percent of this burgeoning population lives within twenty miles of the coast. The great Miami hurricane of 1926 made landfall over a small, relatively poor community and caused about $76 million worth of damage (in inflation-adjusted dollars). Today a storm of similar magnitude would strike a sprawling, affluent metropolitan area of two million people, and could cause more than $80 billion worth of damage. The increase in vulnerability is far more dramatic in the developing world, where in an average year tens of thousands of people die in weather-related disasters. According to the *World Disasters Report 1999,* 80 million people were made homeless by weather-related disasters from 1988 to 1997. As the population and vulnerability of the developing world continue to rise, such numbers will continue to rise as well, with or without global warming.

Environmental vulnerability is also on the rise. The connections between weather impacts and environmental quality are immediate and obvious -- much more so than the connections between global warming and environmental quality. Deforestation, the destruction of wetlands, and the development of fragile coastlines can greatly magnify flooding; floods, in turn, can mobilize toxic chemicals in soil and storage facilities and cause devastating pollution of water sources and harm to wildlife. Poor agricultural, forest-management, and grazing practices can exacerbate the effects of drought, amplify soil erosion, and promote the spread of wildfires. Damage to the environment due to deforestation directly contributed to the devastation wrought by Hurricane Mitch, as denuded hillsides washed away in catastrophic landslides, and excessive development along unmanaged floodplains put large numbers of people in harm's way.

Our view of climate and the environment draws on people's direct experience and speaks to widely shared values. It therefore has an emotional and moral impact that can translate into action. This view is framed by four precepts. First, the impacts of weather and climate are a serious threat to human welfare in the present and are likely to get worse in the future. Second, the only way to reduce these impacts is to reduce societal vulnerability to them. Third, reducing vulnerability can be achieved most effectively by encouraging democracy, raising standards of living, and improving environmental quality in the developing world. Fourth, such changes offer the best prospects not only for adapting to a capricious climate but also for reducing carbon-dioxide emissions.

The implicit moral imperative is not to prevent human disruption of the environment but to ameliorate the social and political conditions that lead people to behave in environmentally disruptive ways. This is a critical distinction -- and one that environmentalists and scientists embroiled in the global-warming debate have so far failed to make.

To begin with, any global effort to reduce vulnerability to weather and climate must address the environmental conditions in developing nations. Poor

land-use and natural-resource-management practices are, of course, a reflection of poverty, but they are also caused by government policies, particularly those that encourage unsustainable environmental activities. William Ascher, a political scientist at Duke University, has observed that such policies typically do not arise out of ignorance or lack of options but reflect conscious tradeoffs made by government officials faced with many competing priorities and political pressures. Nations, even poor ones, have choices. It was not inevitable, for example, that Indonesia would promote the disastrous exploitation of its forests by granting subsidized logging concessions to military and business leaders. This was the policy of an autocratic government seeking to manipulate powerful sectors of society. In the absence of open, democratically responsive institutions, Indonesian leaders were not accountable for the costs that the public might bear, such as increased vulnerability to floods, landslides, soil erosion, drought, and fire. Promoting democratic institutions in developing nations could be the most important item on an agenda aimed at protecting the global environment and reducing vulnerability to climate. Environmental groups concerned about the consequences of climate change ought to consider reorienting their priorities accordingly.

Such long-term efforts must be accompanied by activities with a shorter-term payoff. An obvious first step would be to correct some of the imbalances created by the obsession with carbon dioxide. For example, the U.S. Agency for International Development has allocated $1 billion over five years to help developing nations quantify, monitor, and reduce greenhouse-gas emissions, but is spending less than a tenth of that amount on programs to prepare for and prevent disasters. These priorities should be rearranged. Similarly, the United Nations' International Strategy for Disaster Reduction is a relatively low-level effort that should be elevated to a status comparable to that of the Framework Convention on Climate Change.

Intellectual and financial resources are also poorly allocated in the realm of science, with research focused disproportionately on understanding and predicting basic climatic processes. Such research has yielded much interesting information about the global climate system. But little priority is given to generating and disseminating knowledge that people and communities can use to reduce their vulnerability to climate and extreme weather events. For example, researchers have made impressive strides in anticipating the impacts of some relatively short-term climatic phenomena, notably El Niño and La Niña. If these advances were accompanied by progress in monitoring weather, identifying vulnerable regions and populations, and communicating useful information, we would begin to reduce the toll exacted by weather and climate all over the world.

A powerful international mechanism for moving forward already exists in the Framework Convention on Climate Change. The language of the treaty offers sufficient flexibility for new priorities. The text states that signatory

nations have an obligation to "cooperate in preparing for adaptation to the impacts of climate change [and to] develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas ... affected by drought and desertification, as well as floods."

The idea of improving our adaptation to weather and climate has been taboo in many circles, including the realms of international negotiation and political debate. "Do we have so much faith in our own adaptability that we will risk destroying the integrity of the entire global ecological system?" Vice President Gore asked in his book *Earth in the Balance* (1992). "Believing that we can adapt to just about anything is ultimately a kind of laziness, an arrogant faith in our ability to react in time to save our skin." For environmentalists, adaptation represents a capitulation to the momentum of human interference in nature. For their opponents, putting adaptation on the table would mean acknowledging the reality of global warming. And for scientists, focusing on adaptation would call into question the billions of tax dollars devoted to research and technology centered on climate processes, models, and predictions.

Yet there is a huge potential constituency for efforts focused on adaptation: everyone who is in any way subject to the effects of weather. Reframing the climate problem could mobilize this constituency and revitalize the Framework Convention. The revitalization could concentrate on coordinating disaster relief, debt relief, and development assistance, and on generating and providing information on climate that participating countries could use in order to reduce their vulnerability.

An opportunity to advance the cause of adaptation is on the horizon. The U.S. Global Change Research Program is now finishing its report on the National Assessment of the Potential Consequences of Climate Variability and Change. The draft includes examples from around the United States of why a greater focus on adaptation to climate makes sense. But it remains to be seen if the report will redefine the terms of the climate debate, or if it will simply become fodder in the battle over carbon-dioxide emissions.

Finally, efforts to reduce carbon-dioxide emissions need not be abandoned. The Framework Convention and its offshoots also offer a promising mechanism for promoting the diffusion of energy-efficient technologies that would reduce emissions. Both the convention and the Kyoto Protocol call on industrialized nations to share new energy technologies with the developing world. But because these provisions are coupled to carbon-dioxide-reduction mandates, they are trapped in the political gridlock. They should be liberated, promoted independently on the basis of their intrinsic environmental and economic benefits, and advanced through innovative funding mechanisms. For example, as the United Nations Development Programme has suggested, research into renewable-energy technologies for poor countries could be

supported in part by a modest levy on patents registered under the World Intellectual Property Organization. Such ideas should be far less divisive than energy policies advanced on the back of the global-warming agenda.

As an organizing principle for political action, vulnerability to weather and climate offers everything that global warming does not: a clear, uncontroversial story rooted in concrete human experience, observable in the present, and definable in terms of unambiguous and widely shared human values, such as the fundamental rights to a secure shelter, a safe community, and a sustainable environment. In this light, efforts to blame global warming for extreme weather events seem maddeningly perverse-as if to say that those who died in Hurricane Mitch were symbols of the profligacy of industrialized society, rather than victims of poverty and the vulnerability it creates.

Such perversity shows just how morally and politically dangerous it can be to elevate science above human values. In the global-warming debate the logic behind public discourse and political action has been precisely backwards. Environmental prospects for the coming century depend far less on our strategies for reducing carbon-dioxide emissions than on our determination and ability to reduce human vulnerability to weather and climate.

Daniel Sarewitz and Roger Pielke, Jr.'s "Breaking the Global Warming Gridlock" appeared in *The Atlantic Monthly* (July 2000): 55-64.

Down on This Farm, the Times They Are A-Changin'

Virginia Shepherd

There is no direct route to Joel and Teresa Salatin's Polyface farm in Virginia's Shenandoah Valley. Their farm may be a mere eight miles from Woodrow Wilson's birthplace in Staunton, but to get there, city folk need to pay attention. Joel Salatin's hand-drawn map is scribbled with more than a half-dozed turns that break off without warning onto skinny roads rimmed with wire fences curving in and out of green rye and golden mustard fields, with names like Hebron, Eidson Creek and Trimble's Mill all marking a history of family, church, or the war the South never forgot.

On the other hand, country boys get to the farm in Swoope, Virginia, by gut instinct. They follow the ridges of Little North Mountain or the creek-like Middle River winding through pastures dotted with whitefaced Herefors, low-lying chick houses and stately brick and white clapboard homes. But most of the clients who make the yearly pilgrimage to the farm to fill their coolers with Salatin's "World's Best Chicken" grip the steering wheel in one hand, the map in the other, and stop at each deserted intersection asking themselves, "OK, now which way?"

Why do they bother? At a time when America's love affair with chickens is threatened by reports of bacteria-loaded birds and eggs, financially strapped farmers, and waterways polluted by waste from confinement poultry operations, these consumers are looking for an alternative that appeals to their health and conscience. And they're willing to pay for it. The back roads journey to the Polyface Farm is a road to Mecca for those with a hankering for good, clean, healthy Southern fried.

"I'm the country's premier lunatic farmer," laughs the 43-year-old who wears purple suspenders to hold up his blue jeans and dons a tired by perfectly serviceable straw hat to shade his eyes and balding pate. Salatin and his family raise chickens, turkeys, beef cattle, rabbits and pigs in an unconventional farming operation that requires a leap of faith, a sense of humor and a dash of hair-brained madness to provide a good living. The work also makes sense to the head, heart and land.

When Salatin goes on the road dressed up in a coat and tie to lecture at alternative agriculture conferences, he looks very conventional as he steps up to the podium. But there is nothing mainstream about this man. He's irreverent about nearly everything and reverent about the rest that matters. Referring to one of his slides showing hogs up to their ears in his cow-manure composting project, Salatin explains: "Instead of using things that rot, rust and deteriorate, we use... 'Pigaerators'! They[re appreciating tractors. We buy 'em for $50 and sell 'em for $400. They don't need their oil changed, they don't need spare parts, they don't require minimum wage. They don't complain, and the retirement plan is: when you're done with 'em, you eat 'em."

Welcome to Mr. Green Jeans meets Bill Gates. Salatin's holistic farming operation includes "Tenderloin Taxis," "Chick Chalets," "Eggmobiles" and "Harepens." And it's all done without government subsidies, cost-sharing, nutrient management plans or confinement livestock systems. Furthermore, the 550-arce Salatin farm hasn't seen one teaspoonful of pesticide, herbicide, store-bought fertilizer or seed on pasture in 39 years. Still, every year it produces 8,000 broiler chickens, 400,000 eggs from 1,500 laying hens, 100 head of cattle, 100 pigs, 1,000 rabbits, 700 turkeys and 100 pickup loads of firewood. "Even if this doesn't make economic sense," Salatin insists, "it's still more fun."

But the farm does make money. Yearly, Salatin's operation brings in $200,000. His clear blue eyes narrow as he whispers delightedly, "What we're doing here is impossible!" Joel Salatin has run a farm his way, and he's proud of it.

"OK," says Salatin, "what do we have to do today?" It's 8:30 on a sunny April morning. The redbud is blooming on the hillsides, morning chores are done, and breakfast of scrambled eggs and cheese, grilled sausage, muffins, milk and apple cider is over. Salatin has just returned his Bible to the bookshelf after reading a passable out loud as he does every morning. "It puts us in the right frame of mind to start the day," he explains.

To go over the workday, Salatin calls a Polyface Farm board meeting to order. Members include his wife Teresa, 19-year-old son Daniel, 13-year-old daughter Rachael and teenage apprentices Brad Feyen from Michigan and Gary Dougherty from Virginia. They sit around the big wooden breakfast table in the 18-th century home that belonged to Salatin's parents. There's a fire in the fireplace.

Salatin starts writing. "We need to get the next paddock ready for the pigs, right?" Murmurs of assent.

He scribbles it down, then looks up at Daniel, who is handsome enough to steal the heart of the prettiest girl in the Valley. "You know, they're calling for rain in the next two or three days. Is the rabbit thing ready?"

Although still a teenager, Daniel operates the multi-thousand dollar rabbit operation, raising 1,000 rabbits to sell to gourmet restaurants in Charlottesville, Virginia, and Washington D.C. every year. Because Daniel has bred his rabbits specifically to be raised on pasture in movable pens, he is selling a premium product, and farmers across the mid-Atlantic region interested in starting their own business are looking to Daniel to provide them with hardy breeding stock.

Daniel looks at his dad. "I ordered some big feeders, so I'd like to wait to take them out on pasture on Saturday. I'm hoping the feeders will get here by then."

"OK," says Salatin nodding. "Well... what about cleaning the compost out of the Raken house?"

"Fine," agrees Daniel. The others nod in approval. Salatin jots down a couple more chores and says, "OK, let's start

with the Raken house while we're fresh and strong."

As if on cue, the boys jump up, clap on their cowboy hats and bolt out the door.

The "Raken" house, like nearly everything else on the Salatin farm, has a whimsical name – is a combination of the words "*ra*-bit" and "chic-*ken*." The name is designed to mirror its function. At the heart of Salatin's farming philosophy are three basic tenets: diversity, movement, and multiple use. The Raken house is just one example of the benefits of such a philosophy. It's a 700-square-foot shed with 40 rabbits suspended in cages about four feet off the ground. About 150 laying hens roam the shed floor, picking up the discarded rabbit food and keeping the bedding aerated and composted. Every two weeks, Salatin adds a pickup-truck-load of chips to the bedding to bind with the high nitrogen content of the rabbit and chicken manure. By the end of the year, he's got a two- to three-foot bed of prime compost that floats in your hand and smells, well, earthy, and is spread lightly on his fields. He wouldn't take a million bucks for it. "if we had this much love weight per square foot of either species," says Salatin, pointing to the resting and purring hens below, "we'd have disease. Neither species is at a density that kicks in the pathogens, so we don't have to use medications or vaccinations." This two-tier production system nets $4,000 in the space of a two-car garage. "Who says you need a lot of land to make money?" grins Salatin.

Joel Salatin's kind of commercial farming is radical. On conventional farms, high numbers of a single species are raised in automated controlled facilities, totally removed from their natural environment. These rabbit, poultry and hog operators argue that confinement farming of livestock is the most efficient way to make money, meet customer demand and ensure a sufficient volume of a product of uniform quality.

Salatin begs to disagree. "We're making an industrial paradigm out of everything in agriculture today," he says. "The system is taking the biology out of raising animals. If conventional wisdom suggests 'a chicken ought to lay an egg every day,' then everybody tries to make chickens lay one every day. But when farmers start pushing past what's natural, the costs add up. Nature always bats last."

Salatin has decided to bet the farm on Mother Nature. "It's not just science, it's art, and artists have to think and be creative. We're painting a landscape on our farm."

It all starts with cows. Or it all starts with chickens. Heck, it's a cyclical thing. Salatin has 100 acres of cleared pasture. Every day during the spring, summer, and fall, using an electric fence corral as his "steering wheel, accelerator and brakes," Salatin moves 80 head of beef cattle to a fresh pasture of graze. "We're mimicking the behavior of natural herbivore populations to create a perennial prairie polyculture," he says. "We move the cows to a fresh 'salad bad' pasture every day, and at any one time 98 percent of the farm is at rest. We have 40 species of plants, and each provides a different nutrient for the cattle," he explains.

None of the Salatin pastures have been tilled, plowed or seeded. None of the cows receive a mouthful of grain, antibiotics or growth stimulants. But they're butterball fat and don't need any other feed in addition to their hay in the winter. In fact, his cattle don't normally get anything but what's growing on the ground, except for some mineral supplements and, twice a year, a mouthful of biodegradable all-purpose soap, which Salatin uses as a mild worm medicine. He doesn't have a parasite problem, so he doesn't need high-powered wormers. And the reason he doesn't have a parasite problem is because of... chickens.

"You've heard of the egret on the rhino's nose?" asks Salatin.

Watch any nature documentary on Africa and you'll see birds following herbivores. And so on Polyface Farm chickens follow the cows, pecking out grass seeds and fly larvae from cow patties, pulling up tender green shoots, dining on smalls seeds and dispersing the waste into the soil. "We produce about 96,000 eggs a year as a by-product of our livestock sanitation program," says Salatin proudly. Moveable henhouses dubbed Eggmobiles accommodate 600 free-ranging hens in the pasture.

In another innovative egg-laying model, portable "Hoophouses" and electric "Feathernets" keep the hens in quarter-acre paddocks. The inhabitants of one Hoophouse covered in blue tarp - Rhode Island Reds, Black Australorps and Barred Rock Hens – cluck and coo over the fresh pickings in Salatin's diverse pasture like ladies at a church meeting. Grasshoppers and violets replace tea and cakes, but there's enough fellowship in the scratching to make any prayer group in the Valley proud. Salatin walks to the nesting boxes perched under the hoop to show how they work. Not a good idea. Ruffled feathers aside, the laying hens squawk at this breach of etiquette.

Except that they are chicken, after all. But on Salatin's farm, chickens rule the roost. Every three days, the royal procession moves on to a fresh pasture that suits their discerning palate, and they produce divine eggs.

"The difference is amazing," says Angelo Vangelopoulos, co-owner and chef of the Ivy inn Restaurant in Charlottesville. "Organic is not the issue. It's the color, the flavor, the texture."

"The eggs are far superior," says Tim Burgess, the gruff young proprietor of the upscale Metropolitan. "I don't think twice about buying the eggs," says Burgess, though they cost twice the price of commercial eggs. "we do a lot of desserts here, and there's no comparison in richness between desserts made with these eggs and those made with commercial ones."

Initially his customer's devotion to his eggs surprised Salatin. He figured he had a good product, produced in an environmentally sensitive way, but he didn't know it was that good. "These chefs are artists," says Salatin. "They tell us the difference."

But his broilers are the stars of the show. Tom Bjornsen, general manager of Tastings, raves that

"Polyface chicken tastes like chicken did 30 years ago. It has a clarity and cleanness – a bright flavor that's unmistakable."

So, what's so special about this chicken? It's pastured, and it's moved every day with 80 to 90 of its Cornish Cross buddies in a portable, floorless pen. This is not a new idea. 'Any poultry book published before 1950 has photographs of such structures," says Salatin. But he elaborated on a good idea and has nearly 50 chicken pens staggered across his pastures, home to a batch of broilers every three weeks during the spring, summer, and early fall, as well as turkeys for Thanksgiving. The chickens voluntarily eat more greens and 30 percent less feed, cutting Salatin's feed bills and producing birds that are 70 percent lower in fat with 25 times less bacterial contamination than supermarket chickens. His birds pick up the nutrients as they fertilize his fields. Then his cows come in to graze the new flush of green. The cows are moved each day, followed by the Eggmobiles, with the process repeated through the season. Get the picture? No manure problem, no fertilizer problem, no disease or parasite problem.

One of the big issues in the livestock business these days is waste management. The problem of disposing livestock waste in a safe and environmentally responsible manner has become national news. The Clean Water Network and the Natural Resources Defense Council, in a comprehensive state-by-state report, cite that animal waste from livestock produces 130 times the waste humans generate in this country every year. The report details the serious environmental problems that can be associated with industrial-scale farming that has high concentrations of animals. In Virginia alone, some 1,300 poultry farms produce more than one billion pounds of manure each year, the nutrient-waste equivalent of 2,600 small towns.

National attention was focused on poultry producers a few years ago when an outbreak of the toxic dinoflagellante *Pfiesteria piscicida* in several Eastern Shore tributaries of the Chesapeake Bay caused alarming die-offs of thousands of fish and associated health risks to humans. Because these rivers drain directly into the Chesapeake Bay, the situation was perceived as a grave threat to the commercial fisheries industry. Studies showed that where *Pfiesteria* flourished, highly enriched loads of nitrogen and phosphorus were also present. Because each year some 606 million broilers are raised on the Eastern Shore of Maryland and Virginia and all of Delaware, the finger was immediately pointed at nutrient pollution from poultry litter and other fertilizers.

While the poultry industry may not be definitively linked to the *Pfiesteria* outbreak, both Maryland and Virginia took legislative steps requiring closer management of poultry wastes. Tyson Foods and Perdue Farms, in an effort to reduce the amount of phosphorus in chicken litter in Virginia and Maryland, are adding the enzyme phytase to their feed to improve the utilization of phosphorus in the birds' digestive tracts.

Salatin insists the problem is not an abundance of phosphorus but too

many birds. One reason he doesn't need a nutrient management plan on his farm is because he raises 8,000 broilers a year compared with the 6000,000 broilers raised in one four-house confinement poultry operation. But poultry is big business in Virginia, with cash receipts of $790 million.

If Salatin's operation is so environmentally sound and his chickens are laying the proverbial golden egg, then why aren't all the conventional poultry farmers in the state trashing their high-maintenance, $1750,000 chicken houses, tearing up their restrictive contracts with poultry companies and opting for low-cost chicken pens, farming independence and high profits from pastured poultry operations?

"Pastured poultry is very labor-intensive," says Anne Fanatico, technical specialist with the Appropriate Technology Transfer for Rural Areas, and the USDA-funded national sustainable farming information center in Fayetteville, Arkansas. Fanatico was the outreach coordinator for a program sponsored by the Heifer Project International to train 35 farm families using Salatin's poultry techniques.

From the experience of working with these families, Fanatico is an enthusiastic proponent of pastured poultry, but she realizes its shortcomings. She points out the "huge learning curve" for first-timers. "There is so much to learn about weather, predators, brooding, processing, forage and feed," Fanatico says. "The mortality rate on 100 birds can be as high as 30 percent in the beginning."

Additionally, a farmer must learn to promote the product. Salatin is successful in a niche market, where people are willing to pay more for high-quality food. By raising and processing chickens and selling them directly to customers, he can get more money per chicken than the huge commercial companies get in the supermarket. Plus, he doesn't have any packaging or transportation costs.

And Salatin is lucky. Virginia law allows him to sell his chickens directly to his customers because of an exemption in the federal poultry inspection law. But states can differ in their interpretation and use of the law. Fanatico says some farmers are unwilling to risk starting up a pastured poultry business only to be shut down on a technicality.

And even Salatin had to find his customers. He started 17 years ago taking his smile and inexhaustible enthusiasm to every Rotary, Ruritan or local civic club meeting he could wrangle a speaking invitation from to drum up business for his products. If took him over a decade to build up his customer list to more than 400.

"Joel is such a capable person. He can make it all work, and he has inspired so many people," Fanatico explains. "But I think all the issues involved in operating a successful pastured poultry operation can burn a lot of farmers out, especially if they go it alone." And this just covers the Salatin chicken model. Bringing in his essential diversity of cows, pigs and rabbits adds to the complexity.

Nevertheless, let Salatin get about 30 into one of his talks, and you can hear a pin drop. "I think it's time to build bridges to consumers instead of barriers," explains Salatin. "Let people come to the farm so that children can see where food comes from, how it's produced, and get in touch with the reality of what they eat. When the producer and the consumer are close- that's accountability."

Salatin revs up. "We've got to fundamentally change- and I mean 180 degrees- so we can romance the next generation. Otherwise, we're looking at a dying industry."

Salatin isn't just pontificating. How to keep people, especially young people, on the farm is a major challenge. "Until we attract the next generation, we're just wasting our time talking about sustainability and profit margins and the rest of it. The ultimate test is: Which way will our 18-year-old run when we open the gate?"

Salatin didn't set out to be the leading guru of pastured poultry in the country, though Anne Fanatico insists that he is. "He's been so innovative with livestock and whole-farm planning," she says. But not everyone is thrilled with his methods.

"Speaking at the Cattleman's Association meetings are the worst," says Salatin. "You get a group of about 100 people and all of them are 70 years old. The first thing that happens is that all my jokes get zero response," he grins. "But you've got to understand that my message is threatening to a person 70 years old whose farming experience has never really panned out for him. Its very emotional." He pauses, and the continues thoughtfully. "Your heart decides what your head will believe. If your heart won't open to it, it's just a waste of time."

"Salatin's operation successfully carves out a true niche market, but there's room only for a few like him," explains Greg Hicks, communications director of the Virginia Farm bureau Federation. "Most consumers can't afford to pay the premium prices Salatin charges for chickens and eggs. Because of the incredible demand for affordable poultry products, conventional farming will continue to be the norm. Realistically, the farmers who raise birds in large volumes for poultry processors produce a quality, consistent-tasting bird at a reasonable price. These farmers receive a steady income, something few can accomplish with an independent operation."

When asked how well-received he is among conventional farmers, Salatin replies: "Let's get it straight. I'm not." In fact, Salatin is so far removed from the mainstream that the Virginia Poultry Federation, located just down the road in Harrisburg, Virginia, is barely aware of him. Frankly, Salatin doesn't produce enough to elicit a yawn from the industry. His production is seasonal (he raises chickens according to Mother Nature's rules- you can't put chickens on pasture in the dead of winter), and he's small. His operation is like a no-see-um on the tail feathers of the poultry industry.

But some people are listening. Over the course of a typical week, Teresa logs 70 calls from farmers as far

away as Canada and Australia. Every three years, the Salatins host a Polyface Field Day, inviting the public. At their last one 725 people showed up.

It's taken Salatin almost 20 years to perfect his style of farming, and he's not finished yet. A few years ago, Salatin was listening to a lecture when a slide of a heritage breed of hog appeared on the screen. Salatin overlooked the hog. It was the manure pile the pig was standing on that grabbed his attention. "Hit me like a bolt of lightening," he says. He'd been trying to figure out how to eliminate the machinery from his windrow composting system, where huge mounds of chips and manure need to be turned on a regular basis to make compost. Now it was clear. He'd bring pigs in to do the dirty work.

Salatin confines his cows in the winter, and every week adds chips or leaves to the manure mix, along with a sprinkling of corn. By spring, he's got a three-foot-high "electric blanket" of percolating compost the cows are lounging on. Once the cows move out to pasture, the pigs march in. These pigs are ready, and once they're on that pile, they waste no time. "By next week," Salatin says, looking at his hogs rooting through the compost to get to the corn, "all you see is their tails."

No wonder there are plenty of people who are open to this unconventional, unorthodox method of farming. It's fun. But there's something else about it that's even more basic.

"We believe there are things that are right and things that are wrong," says Salatin. "I don't want to make so much money on this farm that we lose sight of what we're here for. And so...," he flashes an impish grin, "that's one reason to give a lot away!" He laughs. Then his eyes narrow and he gets serious. "Now, look. I don't mind making money. But we do give a lot away. We enjoy it."

Salatin doesn't wish to feed the world. He insists his operation can't get much bigger and still maintain its environmental and ethical integrity. He'd rather farmers he meets try a little "landscape painting" on their own. His mantra: there's plenty of room for all to experiment. And that's the way to change the system.

After the Bible lesson that peaceful April morning, Joel paused, bowed his head and prayed. "Encourage us to walk by faith and not by sight. Let us be good stewards of all that You've entrusted to our care, and let us be discerning and wise, and make decisions the way You would if You were right here in person."

Virginia Shepherd's "Down on this Farm, the Times They Are A-Changin'" appeared in *Smithsonian* (July 2000): 64-72.

Betting on Designer Genes

Jeff Wheelwright

"Scientists dream of giving people new genes that will stop a disease or fix a problem. It is harder than anyone thought."

Like strand of DNA, which coils all over itself within a human cell, the biotechnology industry in San Diego is full of loops and tangles. Biotech, a big part of the "new economy" of the United States, is especially big in this seaside community, where the climate is said to be "technologies-perfect" and the race to pit human genes to medical use has brought together large drug companies, shoestring start-ups, university labs and government hospitals.

If San Diego used to stand for bougainvillea, retired admirals and perpetual defense contracts, it now has a street named Genetic Center Drive. The new biotech ventures may have small facilities, and the corporate officers might consist of three shaggy scientists in sandals. But investors are betting that the genes cloned by the companies will deliver new treatments, or even cures, for heart disease, cancer and other ailments.

San Diego's biotech nucleus is Torrey Pines Mesa. Located north of downtown, in La Jolla, the mesa is a steep, sandy promontory rising from the Pacific. It is home to both the Salk Institute and the Scripps Research Institute, and at the top of the mesa is the University of California, San Diego (UCSD). Many industries in America have been built upon ideas originating on university campuses. The gene business is unusual in that researchers have been able to patent and commercialize their ideas without relinquishing their university appointments. UCSD itself has become a biotech player, supplementing its government grants with money from pharmaceutical manufacturers.

Stroll through the eucalyptus trees to the UCSD School of Medicine. In the Center for Molecular Genetics, you'll find the laboratory of Theodore Friedmann, M.D. He heads the university's program in human gene therapy business long before it was a business- when the idea of manipulating genes to remedy disease was just a concept.

A gene is a message, a biochemical message inherited from your parents. It is one of 50,000 to 150,000 messages that have helped to shape your body or make it run. Each gene consists of a section of DNZ, that helical polymer that looks like a twisted ladder. It is actually the rungs of the ladder, composed of just four molecules that can be arranged in seemingly endless combinations, that will tell the cell what to do. (In shorthand, the molecules are labeled A, G, C, and T.) Often a cell is told to produce a protein that will carry out the work of the body. When a disease results from an absent or insufficient or malformed protein, the problem usually can be traced to a glitch in the DNA.

All this had been outlined as far back as 1972. That year Ted Friedmann and another scientist wrote a seminal article, "Gene Therapy for Human Disease?" alerting the public to the technical and ethical issues on the horizon. There was a possibility, they wrote, that the "'good' DNZ [could] be used to replace the defective DNZ." Fixing the disease at its source in the cell made more sense than replacing the bad protein over and over, as drug therapies did.

But how would the "good" genes be inserted? The Friedmann paper proposed using artificial viruses. Because the whole purpose of a virus is to insert its DNZ into a cell and force the cell to work for it, the idea was to make viruses serve as the carriers, or vectors, or beneficial genes.

With the blueprint for the gene therapy established, the technology slowly took form. First, techniques were developed enabling scientists to precisely identify the DNZ lettering of genes. They learned to make copies of segments of the specific letters, and then to "write" genes and grow them in bacterial cultures. 'Libraries" of genes were developed from which researchers could obtain the living instructions for both making proteins and making the components of the viruses that would transport them.

To make a vector, scientists took the genes for the parts of a virus and the genes for therapeutic proteins and put them, one by one, into "helper cells." These are special cells from mice, dogs or even humans that are receptive hosts for the propagation of whole viruses. When all the components are added to these cells, new gene-carrying viruses are automatically created. By careful cultivation, trillions of the gene-carrying viruses can be produced, harvested and prepared for eventual clinical use.

Friedmann studied a gene called HPRT. When this gene is not working, the body can't produce a critical enzyme, the lack of which leads to a rare but terrible condition called Lesch-Nyhan. In an experiment in the early '80s, Friedmann and his associates became the first to insert a disease-related gene- the HPRT gene- into cells in which the gene was defective. In lad cultures, the corrected cells produced the critical enzyme. For this and other work, some in the field have called Ted Friedmann, now 65, the father of gene therapy.

But you won't hear him say it, for Friedmann has not yet fixed the disease in human beings. Lesch-Nyhan turned out to be too complex. And widespread gene therapy in general has remained an idea on the horizon, if very much closer today. Since 1990 more than 350 trials have been launched in the United States, enrolling 4,000 subjects, but a proven and permanent treatment of the sick by altering their DNA has not occurred. Over the years that he has lectured on the topic, Friedmann always starts with the gulf between the concept of gene therapy, so glowingly simple, and the thorny implementation, "which will take slow slogging, clinically, until a success." Careful with words, he thinks that "gene transfer" more accurately describes the current state of the field.

The success that Friedmann long anticipated may well have come last spring, two breakthroughs in treatment, actually, although the elation was overshadowed by bad news arriving first. In September 1999, Jesse Gelsinger, a teenager with a metabolic disorder, died during an experiment at the University of Pennsylvania. It appears he had a fatal reaction to a virus bearing therapeutic genes into his system.

Ever since gene therapy moved out of the laboratory and into the clinic, the problem has been to get the desired genes into the right cells in sufficient numbers. In the Gelsinger experiment the target cells were in the boy's liver, where his metabolic disorder was based. The vector used was an adenovirus, of the family of viruses that cause respiratory infections. The DNZ of the virus had been crippled so that it could infect the liver cells but not reproduce there. Also, the virus was fitted with the gene for making the missing enzyme. Millions of copies of the vector were injected into a liver artery.

After Gelsinger's unforeseen reaction, a number of institutions using adenoviruses in humans halted their gene therapy trials, at least temporarily. Then other deaths, in other trials, came to light. The deaths were not necessarily attributable to the vectors, but rather to the serious diseases that had inspired the tests. Still, it was found that several researchers had not reported their "adverse events" to the National Institutes of Health, as was required. Congress held hearings, and the Food and Drug Administration, which has ultimate authority, tightened its oversight and issued disciplinary actions, though not satisfying everyone. Speaking for many, David Baltimore, president of Caltech and an esteemed biologist, asked, "What the hell are we doing putting [adenoviral vectors] into people?" The controversy worried Friedmann.

The lead investigator at UPenn, James Wilson, was criticized for having his feet in both camps. He stood to gain financially from the outcome of his experiment. Friedmann believes that conflicts of interest should be scrutinized, but that in this instance the fault lay in the team's inexperience. In preliminary trials with monkeys and human volunteers, the adenoviral vector caused liver problems, reactions which may have been misinterpreted. Last November, a lawsuit filed by Gelsinger's family was settled out of court.

The two successes overshadowed by Gelsinger's death were the real thing. A team of researchers in Paris reported last April that they had corrected a severe type of immune deficient in two infants. First they withdrew bone marrow cells from the children. Then they used a retro-virus to infect the cells with the necessary gene. Put back into the patients, the cells began churning out the protective components of the immune system. "Patients with immune systems fully restored," Friedmann points out. "All tests show the patients normal."

The other report concerned a hemophilia treatment developed by American researchers. In hemophilia the blood fails to clot properly. Patients must receive a clotting factor by means

of costly infusions that continue for lifetime. In type B of the disease, patients lack a protein called Factor IX, controlled by a gene that in them doesn't work. So for the trial a vector modified with the healthy gene was injected directly into the muscles of three subjects. The number of subjects was kept small because the goal was to assess the safety of the technique, not the efficacy. But early results showed that factor IX was being generated in two patients.

"They [the researchers] reported a correction of a bleeding disorder that has lasted well over a year," notes Friedmann. "A physiological event has occurred, not jus the identification of gene product in the molecular assays." In other words, not only was a gene directly transferred into human beings but it was also doing what it was supposed to do.

Friedmann's own resaerch has lately focused on retroviruses. Different from an adenovirus, a retrovirus uses its RNA to get its DBZ incorporated into the DNA of its target cells. Friedmann's specialty, and one of the hallmarks of this lab, is creating retroviral vectors, the type most commonly used in gene therapy tests. In incubators and centrifuges whirling just across the hall, retroviruses are being built from scratch. His associated, young Ph.Ds on grants, cut out part of the retroviral machinery and splice in DNZ corresponding to a human gene. They also tinker with the virus's outer envelope, sticking proteins onto it that make the virus perform new tricks within the body, such as seeking out specific cells to infect. "ordinary viruses are promiscuous," he comments. "They go where they want to go."

Friedmann is not overawed by the creation of viruses. To him the retrovirus is a tool. "It's a bag of protein with RNA inside," he says coolly, "a bag with an ability to get inside cells. To make a vector, you can strip down a natural virus or engineer one from the bottom up."

The lab makes "research-grade" vectors. These first novel samples aren't deemed ready to be inserted into human beings. For that you must have a "clinical-grade" vector, one that has passed inspections and met government standards. Friedmann makes reference to "GMP"- good manufacturing practices. The term is taken from the FDA. There is a GMP, clinical-grade, commercial vector lad on the medical school, campus, a short walk away. Friedmann and UCSD set up in 1995 and later secured capital from a foreign drug company.

"Production was needed in large amounts," he says, a;; of a sudden sounding like a businessman. He opens the door to a nondescript down building. "UCSD saw the need for good material that you could inject into humans. The idea was that we would spread the clinical use of 'clean' vectors. We concentrated on this aspect to spur the field."

The company's name is Molecular Medicine LLC. Charles Prussak, the company president, is something of a hybrid. A PhD., he started professional life as a research biochemist and saw his DNZ taken over, as it were, by the hot virus of the

marketplace. His phone ringing constantly, his office walls bare, he relishes the dare and competition of the gene business. "There's a tremendous risk for a tremendous reward," he says. "You're either a bum or a star."

In contrast to the reserved and courtly Friedmann, Prussak, 46, is a rapid-fire guy, humorous but sharp with his elbows. "GMP," he says, gesturing at the forms on his desk, "stands for Generate Mountains of Paperwork. There's a demand for reporting at each step of the [manufacturing] process." Not only is the FDA looking over his shoulder, Roche, the corporate parent, like the rest of the industry, is nervous about vector safety since the death of Jesse Gelsinger. But Prussak, unworried, insists, "One of these products will be out in a few years and we'll have gene therapy."

Molecular Medicine's customers are pharmaceutical and biotech companies for the most part, which are developing their gene therapies in private. Prussak cannot reveal the companies' names. They send in their resaerch-grade vectors, complete with a gene, for scaling up under controlled conditions.

A contract is signed, and the vector goes into production. The lad here is hardly larder than Friedmann's, but bigger equipment fills the space and the production rooms are sealed. To guard against contamination, workers are sampled at each entry for free-riding particles and bacteria. "The purpose of gowning," says Prussak, "is to protect the people from the virus and the virus from the people." The most critical step in the process is at the end, "when we're doing a fill"- putting the vastly multiplied and purified vector into containers for shipment to the customer.

Was one of his customers by any chance Collateral Therapeutics, founded by UCSD cardiologist named H. Kirk Hammond?

Prussak just smiles.

Proceeding 100 yards east on the mesa, you come to the VA San Diego Healthcare System, which is affiliated with the university. Dr. Hammond keeps an office and a lab in the building. Many of the aging veterans being treated here suffer from heart disease. When the arteries become impeded by plaque, the blood can't get enough oxygen to the heart muscle, especially when the heart is beating fast during exercise or stress. Chest pain called angina results. Angina affects six millions Americans, who represents but 10 percent of those with cardiovascular disease. Drugs can relieve angina, and if not, balloon angioplasty, the forced widening of an artery, may clear the blockage. The most invasive but effective operation is to bypass the sick arteries by grafting veins harvested from the leg or redirecting mammary arteries.

Curing coronary artery disease (CAD) is likely to pose a harder challenge for gene therapists than do the rare metabolic disorders in which a single gene is defective and one restored enzyme can turn things around. CAD is "complex, multigenic, multifactorial," observes Friedmann. That genes have a role in its development is incontestable, but lifestyle and diet probably are more important factors.

What if, instead of trying to correct the narrowed or blocked vessels, doctors could help patients to make new ones? The body does this naturally, sprouting small vessels and capillaries, called collaterals, to provide more blood to the vascular regions where blood flow is poor. A heart under stress of exercise, will make collaterals. Scientists are familiar with the proteins that stimulate the formation of such blood vessels. Called growth factors, the proteins each have a gene regulating their production. In recent years these genes have been located and cloned.

Now, what if a diseased heart were fed the means to make extra growth factor? Wouldn't the collaterals and blood flow be increased?

To the bottom line: rival heart researches, Hammond being one, are trying to show that their patented methods of delivering growth-factor genes will lessen the pain of angina and allow longer periods of exercise.

Encouraging the growth of collaterals to ease the functional impairment caused by CAD would seem to be a proper medical use of a technique. But it is easy to see that the same skills could be used to enhance the body of a well person. If you look down the road in gene therapy, you will see, not too far off, attempts to change healthy human beings in order to make them better. If the changes are made to sperm or egg cells, the changes may be passed on to subsequent generations. Ina word, eugenics is coming. (You might wish to go back to Friedmann's lab and discuss the matter. Eugenics got a bad name because of experiments by the Nazis in the 1930s and '40s, but Friedmann, though a Jew whose family fled the Nazis, is not hostile to eugenics. "You're going to have to face it," he says. "As a public health measure to treat disease, it's OK." As for the possible abuses of eugenics, "it's the social response that's evil," he says, "not the scientific information.")

Kirk Hammond founded the Collateral Therapeutics in 1995 with a few partners. "I sure know a lot more about business than when I started out," he says. "We were five guys and a dog. We had nothing." They had a method to inject a growth-factor gene into the coronary arteries, using a catheter loaded with altered adenoviruses. The next year Hammond published findings that the gene transfer worked in pigs and their heart function improved. In 1996 Collateral Therapeutics landed a major backer in Berlex, the U.S. subsidiary of the German drug giant Schering. In 1998 they went public.

He leans across his desk. The 51-year-old Hammond is a dark-bearded, intense, with an almost wolfish presence. For a medial school professor to have launched a stock offering was a controversial move among old guard academics on campus, he admits. "You're perceived in a different way, and it was painful, but I stuck with it. I believed that full disclosure of our financial backing was the way to go. The university is not in the business of commercializing the inventions of its inventors. With corporate arrangement, rapid advances are possible- far more than I could do on NIH grants."

Indeed UCSD, holding title to his patents, seems behind Hammond all the ay. "There's no loser in the arrangement except to the sheltered academic who fusses about the old days," he says. "I used to be one of those guys until I made a discovery."

To minimize the conflict of interest, Hammond did not take an active part in the tests of his technique. It's fine by him that the experiment was farmed out to clinicians around the country, at 12 medical centers in all, although eight patients did have their gene injections here at the VA hospital. Hammond and his associated insisted that a control group be included in the trial. One subject in four got a squirt of saline solution only, a placebo, instead of hundreds of millions of viral particles. Their results were compared with those for the patients who received the genes.

Because the FDA requires that the safety of a new technique be established first, the trial was intended to assess the possible danger of the injections as much as the possible benefit. Hammond is cagey about the outcome, for it hasn't been published in a journal yet. "The treatment was safe, I can say that much," he declares, and the company has announced "positive" preliminary results. According to a doctor involved, some patients did show improvement after receiving GENERX, as Collateral named the product. To be exact, some in the trial were able to exercise longer on a treadmill without chest pain halting them, whether it was because of new blood vessels of some other reason. Now a full-scale test of the effectiveness is planned, the last major hurdle before licensing.

A few turns down the hall from Hammond's office is the hospital's cardiac catheterization lab, headed by Dr. William Penny. Penny conducts such procedures as angiograms and angioplasty. A catheter, a tube less than two millimeters wide, enters through an artery in the thigh and is threaded up to the region of the heart. A dye is injected that shows up on x-rays. The x-ray pictures show the vasculature enmeshing the heart and any blockage of it, hence the degree of disease.

Penny plays a videotape of a recent angiogram. The catheter squirts dye like a runaway garden hose around the heart. Parts of the image are blank though, not spidery-looking, which means that the contrast material isn't getting into the smaller veins. The beating muscle is being deprived of blood and oxygen.

"This patient previously had open-heart surgery," Penny explains. He points out the grafted vein, "the only one that's still fully open." The vein disappears into an ominously blank area. Springing off the graft are tiny branches of collaterals.

"Collaterals are nature's way of performing a bypass," remarks the doctor. "Sometimes that's totally sufficient, and other times these new vessels can't cut it. We don't wish to open this man's heart another time. We're trying to get his heart to grow more collaterals."

A week earlier Penny administered GENERX gene therapy to the man. That is, he had three chances in four of getting it. The subject is in the waiting room right now, as it happens,

having come back for his initial checkup. So the trek across the mesa has reached its goal. Not in a medical laboratory or corporate boardroom but at the side of one person in need.

John smith (not his real name) is a cheerful, ruddy, 65-year-old ex-construction worker, who looks a bit like Santa. "When people say I look good, I say all my scars are on the inside," John jokes. But the picture of health is belied by the delicate way he moves, a watchfulness about his body, lest he strain his tender heart.

Because he was one of the last subjects to enter the trial, it's too soon at ant rate for change to have occurred-good changes, more collaterals around his heart, or bad changes, it must be said, if the growth-factor gene were to migrate elsewhere, such as to his retinas, and produce unwanted capillaries.

All the risk have been explained to him, he says. John has battled angina for 20 years. He was forced to retire at age 51. Two heart bypasses have stripped his legs of veins, and further surgery might not even be possible. "I didn't have anything to lose," he says. "When I heard about [the trial[, I was jazzed about it. They can try this stuff out on mice, but the human part is necessary. I'd be helping myself if it worked, and it could be helpful to other people too.

"Yeah, I thought about dying," he adds, "but it's only when you're not feeling well that you think about it. First you're out of breath, then the pain. I'd like to get on a mountain bike again and ride five or six miles.

"Since I've been in the study, I've seen a couple of things on TV about gene therapy. Every time I hear about it, I'm wide-eyed and bushy-tailed. There are miracles out there."

Jeff Wheelwright's "Betting on Designer Genes" appeared in *Smithsonian* (January 2001): 29-30, 32-36.

Chapter Three

The Resume and Cover Letter

The Assignment

Prepare a resume and cover letter in response to a specific, published job posting or advertisement. I recommend you use a posting in a newspaper or on the internet so that you can offer a print copy. You must bring in a copy of the job listing for peer revision day and hand it in with your final assignment.

Unless your instructor chooses to set forth more specific guidelines, here is the assignment:

- Each document must be one page only (unless your instructor indicates otherwise).
- You must turn in the job announcement with your assignment or it is incomplete.
- These documents should be prepared according to standards discussed in class.
- They should be proofread very closely so that there are no errors in either document.
- The assignment and any drafts discussed in class must be turned in according to the schedule set by your instructor. If you fail to turn in the assignment on time or if you fail to have a sufficient draft for peer revision, it will affect your grade for the assignment.

Review the guidelines offered in the Career Services booklet, the coursepack, and any supplementary texts or guidelines your instructor offers.

Students must bring the job advertisement on the day of peer revision, since without it peers and instructors cannot judge audience expectations. The resume should be ordered in a way that best responds to the potential employer's needs, and the cover letter should offer significant details distinguishing the candidate and highlighting aspects of the resume in a way that clearly responds to those needs. The cover letter should offer a high level of detail and should interpret the resume for the potential employer.

I am always surprised by the level of error on the resume, which ought to have absolutely no errors of syntax, grammar, consistency, or sense. Errors in consistency (in spacing, parallel form, layout, and capitalization) are especially prevalent. General sloppiness or failure to adhere to accepted principles (such as using active verbs) will definitely factor into your grade.

Resume and Cover Letter Samples

The following comments and questions will help you think about the sample resumes and cover letters.

Joel Anderson

After meeting Sara Creighton at a career fair, Joel Anderson submitted this cover letter and resume. Notice how Joel followed recommended guidelines in organizing his cover letter. The introductory paragraph identifies the position sought and forecasts the letter's content. The second paragraph discusses Joel's qualifications for the internship position. The third paragraph explains how his work experience has developed computer skills, which are valuable in any field. The final paragraph requests an interview and states Joel's phone number and email address. Likewise, Joel's resume is clearly organized and balanced in format.

However, upon closer examination, we see the substance of Joel's letter and resume require revision. How might Joel better tailor his letter to his audience? How could Joel more accurately forecast the key points of his letter in the introductory paragraph? How could he be more specific when describing the skills he has developed? Where would transitions help to better show the logic between his ideas? What unnecessary words could Joel eliminate? Which skills do you confidently believe Joel has? Why? How might the concluding paragraph more politely and confidently request an interview? What revisions would you suggest to improve Joel's resume to make it clearer and more specific? Remember that details lead the reader to conclude that the writer is a terrific job candidate; telling the reader "I am terrific" is unconvincing.

Joan Parker

Joan's experience seems quite appropriate to the internship. But has Joan's letter emphasized her most relevant experience? What could the writer have done to be more specific in the letter? What abilities is the employer most likely looking for in a job candidate? How might Joan better tailor her letter to highlight these abilities? How could the resume be improved?

Lynn Cato

Lynn has the benefit of varied experience in the area of animal handling. She runs the risk, therefore, of simply listing her many credentials and missing out on the opportunity to present herself—her motivations and concerns. However, she does a fairly good job responding to items in the job description and presenting her enthusiastic and caring personality. Notice the third paragraph, where she describes her reaction to a problem she saw in the waiting room. Although she does not mention the term "self-motivation," she gives an example of that term in action when she talks about the seminars she developed to teach children about animal care. What better information could she have listed as a bullet under her work for Dr. Morris, rather than the obvious "updated pet records?" One would assume any veterinary receptionist would have to do that.

Gregory Benjamin

Gregory does a nice job balancing his construction experience with his academic experience in his cover letter. Although he has only worked for one company, he stresses his varied work experience and ties it in nicely with his Public Health major. He forestalls any concerns that the owner of Robbyns' Restoration and Roofing might have about his being able to handle both school and work by showing that he has already been doing that very well, and gaining valuable time management skills. He even emphasizes that his organizational skills will help the company stay on schedule and improve customer relations. He presents himself as a superior candidate; that might seem brash, but the details he provides back up his claim. What do you think about the tone of the letter? How might his confidence appeal to or annoy his potential employer? When would this tone be appropriate, and when might it backfire?

Steven S. Adamo

Steven's resume and cover letter show how a student can tailor coursework to meet an employer's needs. What abilities can we assume the employer is looking for in a job candidate? How does Steven present his coursework as work experience? How might Steven express himself more concisely? In the third paragraph, how do the skills Steven describes give further evidence that he is a good worker? How might Steven shift this paragraph from "telling" the reader he is a problem solver to "showing" the reader he is a problem solver?

Candice Common

Notice how Candice's cover letter effectively expands on her resume, describing key details of her employment history. How does Candice frame these details around a potential employer's interests in the second and third paragraph? For example, why might an employer be especially interested in the "strong clientele" Candice can build? How does Candice preview these key ideas in her introduction? What transitional phases show the logic between Candice's ideas? Examine how Candice uses these phrases to link the chronology of her employment history and to link her cosmetic abilities to her business skills. What do you think about the letter's tone? Are you convinced that Candice has the abilities she lists in her cover letter and resume? Why?

11111 RPO Way
New Brunswick, NJ 08901

July 21, 2001

Ms. Sara Creighton
Financial Representative
Northwestern Mutual
New Brunswick, NJ 08901

Dear Sara Creighton,

After briefly speaking with you at the Rutgers Career Fair, I am now interested in an intern position at Northwestern Mutual following the spring semester of 2002. I have carefully read through the information packets that you have given to me, and I am very familiar with the skills which your firm is looking for.

Employed as a customer service representative for a commercial bank has allowed me to learn the importance of being a team player. I soon learned the importance of helping an organization to maximize their profits. Furthermore, I had the opportunity to build personal relationships with customers.

In addition, I've worked at Bloomburg which gave me the opportunity to work with a diverse community where I did individual projects for four different departments. These projects strengthened my computer skills because I had the opportunity to test my ability with Microsoft Word, Access, and Excel outside the classroom setting. Various times throughout this internship, I went beyond what was expected in my duties.

I am seeking a position that would offer challenge and continued growth opportunity. My passion for doing the job right and taking on responsibilities and challenges make me a strong candidate for this position. I would also strive to make lasting improvements and to work in whatever capacity necessary to succeed. You can contact me at 555-555-5555 and at JLA99@eden.rutgers.edu.

Sincerely,

Joel Anderson

Enclosure

JOEL ANDERSON

JLA99@eden.rutgers.edu

CAMPUS ADDRESS
Rutgers University
11111 RPO Way
New Brunswick, NJ 08901
(732) 111-1111

PERMANENT ADDRESS
41 Allen Court
Ramsey, NJ 07013
(201) 111-1111

EDUCATION:

Rutgers University, New Brunswick, NJ
B.A. Marketing, May 2004
G.P.A.: 3.7

EXPERIENCE:

USAA Bank, Ramsey, NJ *July 2000-Present*
Customer Service Representative

- Participate in weekly meetings.
- Process various financial transactions for customers.
- Resolve customer inquiries and questions about their accounts using CRT System.
- Collect data to create reports in Access and Excel.
- Assist the bank's personal banking representatives and investment specialist to increase sales and profit by promoting the bank's products and services.
- Recognized formally with two appreciation awards.

Bloomburg, New York, NY *June-August 1999*
Summer Intern

- Provided weekly reports via Access and imported to Excel.
- Presented ways of improving website to managers and implemented those changes by working with other employees and using HTML.
- Researched E-commerce companies on the Internet.

Outback Steakhouse, Edgewater, NJ *May 1998-Aug. 1998*
Waiter

- Developed good working habits in a fast-paced environment.
- Responsibilities included: making sure weekly schedules were fair and organized, looking after the upkeep of the floor, hosting.

SKILLS:

Microsoft Windows, Microsoft Office, Internet Explorer, HTML
Strong interpersonal skills, superior oral and written communication skills, thrive in challenging situations

122 George Street
New Brunswick, NJ 08901

February 4, 2000

Mr. James Barra
Air Cruisers
PO Box 180
Belmar, NJ 07719

Dear Mr. Barra,
I am very interested in working as an Industrial Engineer for your company this summer. I learned of the position from the Internship Guide provided by the career services at Rutgers University.

I will be completing my third year as an Industrial Engineering student at Rutgers. I have taken and excelled at manufacturing, work design, and other courses that relate directly to this position. The projects I have done in these course have provided me with knowledge and experience in the practical applications of engineering. I would like to use this knowledge and experience to benefit your company.

I have encloses a copy of my resume which further describes my educational background as well as my work experience. I look forward to hearing from you soon. Thank you for your time and consideration.

Sincerely,

Joan Parker

Joan Parker

CAMPUS ADDRESS
Rutgers University
11111 BPO Way
New Brunswick, NJ 08901
(732) 777-1111

PERMANENT ADDRESS
419 College Avenue
Pittsburgh, PA 88888
(814) 111-1111

EDUCATION:

Rutgers University, College of Engineering. **New Brunswick, NJ**
B.S. Industrial Engineering, expected graduation date, May 2003
G.P.A.: 3.29

HONORS:

Dean's List, Fall 1993, Spring 1995 through Fall 1996
Edward Bloustein Distinguished Scholar
Member, Alpha Pi Mu, Industrial Engineering Honor Society

RELEVANT COURSEWORK:

Work Design and Ergonomics-***Fabric Co. Consulting Project,*** Deterministic Models in Operations Research-***Optimization Project,*** Manufacturing Processes-***Salt Shaker Design Project,*** Engineering Probability-***Bakery Consulting Project,*** Design of Mechanical Components-***Duplexer Device Design Project,*** Accounting for Engineers, Intermediate Statistical Analysis

EXPERIENCE:

Byers Engineering Co., Somerset, NJ, July 2000-Present
Administrative Assistant

- Aided in the operation of an engineering office.

Six Flags Great Adventure, Jackson, NJ, Summers 1998, 1999
Security Officer

- Screened incoming park guests.
- Responsible for the handling and logging in of confiscated materials.
- Maintained appropriate safety and security conditions.
- Trained new officers.

Express, East Brunswick, NJ, June 1997-October 1995
Retail Salesperson

- Provided customer service.
- Assisted with merchandise displays.
- Trained new employees.

COMPUTER SKILLS:

BASIC	C	SIMON	Word
FORTRAN	LINDO	Excel	Symphony

ACTIVITIES:

Member, Society of Women Engineers.

Haclion University
Campus P. O. Box 867
Forrest Glen, DC 88888
April 20, 2001

Job Advertisement: VETERINARY ASSISTANT: part-time, flexible hours Must be reliable, self-motivated, people and animal friendly. Good experience for pre-vet students. Call us at 888-888-8888.

Dr. Gilbert Sullivan
Companion Animal Hospital
824 Poplar Street
Hillside, DC 98888

Dear Dr. Sullivan:

I would like to be considered for the position of veterinary assistant. I learned of this opportunity from your advertisement in the *Haclion Campus News* on April 19, 2001. I am currently a third year pre-veterinary major attending Haclion University, and I would love to take advantage of the wonderful learning experience working at your hospital would bring. I feel that I could contribute to your practice and relate to your patients in a caring and professional way.

I have previously worked with veterinarians for both small and large animals at school and during the summers. I have learned valuable customer relations skills in dealing with pet owners at veterinary clinics, and also at the kennel where I work to provide people with calm, well-behaved dogs. Currently, I am enrolled in a class which allows the students to do tests on a group of twelve foals in addition to training them. I have taken blood from these foals for glucose tolerance tests and assisted in ultrasounding them for body fat. Along with my work with Drs. Morris and Bell, I have also visited the Pennsylvania Equine Center and spent the day with one of their vets, Dr. Josiah Brennan. I assisted in a castration and helped him with the various patients he had that day. In the past few years I have worked with a wide variety of animals including horses, dairy cows, dogs, cats, and sheep. Simply, I enjoy helping all animals in any way I can.

At the last veterinary clinic I worked at, I noticed that the children in the waiting room often did not know how to behave around other people's pets—or even their own! With the support of Dr. Morris, I developed a series of seminars to train children of pet owners how to care for and be affectionate with their animal companions. I also taught them how to behave around a strange animal. These seminars were well-received by the children, their parents, and the clinic staff. I am enclosing a copy of my resume, which provides more information about my motivation and my ability to work well with people and their animal friends. I can be reached at 888-009-4573 or at lynncato@cl.com. I look forward to hearing from you. Thank you for your time and consideration.

Sincerely,

Lynn H. Cato

Lynn H. Cato

Lynncato@cl.com

Present
Haclion University
Campus PO Box 867
Forrest Glen, DC 88888
(888) 009-4573

Permanent
298 S. 18th Ave.
Catesville, PA 10324
(764)-000-9087

EDUCATION

Haclion University, Forrest Glen, DC
Pre-Veterinary Major, Equine Science Minor,
Expected date of graduation: May 2002. GPA: 3.2

HONORS

Haclion Distinguished Scholar, 1999, 2000

RELEVANT COURSES

Animal Science, Animal Nutrition, Animal Reproduction, Dairy Cow & Horse Handling, Horse Management, Animal Problems

EXPERIENCE

Kennel Manager/Dog Trainer, Summer 2000-Present
Noah's Ark, Brattington, VA
- Responsible for care and exercising of all boarded dogs
- Ran dog obedience classes
- Aided visiting veterinarians and groomers

Volunteer/Assistant, Summer 2000
Dr. Maria Bell, Equine Veterinarian, Owens, VA
- Performed flex tests on horses to check for lameness
- Assisted in ultrasounding mares to check for pregnancy

Barn Manager/Horse Trainer, Summer 1999
Turnaround Farm, Catesville, PA
- Responsible for feeding and exercising of about forty horses
- Trained various horses for hunter/jumper competitions
- Taught beginner lessons
- Assisted visiting veterinarians and farriers
- Groomed at various horse events and shows
- Helped customers find an appropriate mount

Veterinary Assistant/Receptionist, 1995-1999
Dr. Bernard A. Morris, Catesville, PA
- Assisted during small animal surgeries
- Responsible for feeding and bathing dogs and cats
- Wrote letters to clients and updated pet records

SKILLS

Microsoft Word, Microsoft Excel, Internet

ACTIVITIES

Haclion Student Safety-Mounted Patrol, Fall 1999-Present
- Patrol campus on horses and report problems to police

Member, Animal Science Club, Fall 1999-Present
Member, Catesville Equestrian Team, 1995-1998

Haclion University
Campus P. O. Box 984
Forrest Glen, DC 88888
February 5, 2001

Mr. Howard Robbyns
Robbyns' Restoration and Roofing Co.
197 Essex Street
Hillside, DC 98888

Job Advertisement: Needed: Field Supervisor. 2-3 experience with roofing and remodeling required. Ability to speak Spanish a plus. Bring resume and references to: Robbyns' Restoration and Roofing, 197 Essex Street, Hillside, DC 98888. EOE

Dear Mr. Robbyns:

I am writing to express my interest in the position of field supervisor for your company. I learned of the opening from the February 4, 2001, *Washington Post* classifieds and feel that I am a superior candidate for this job. I can offer you my knowledge of onsite safety and my hand-on experience in construction, as well as my ability to work well with a variety of people.

For several years I have been a supervisor for Herb Chundley Construction, a company handling the remodeling and renovations of homes and modular units. I have worked on several large projects as well as smaller scaled jobs and have dealt with the completion of several projects at the same time. The leadership qualities I have learned over the years will be invaluable in a supervisory position. Both on the job and as a member of Labor Union #934, I have learned how to deal with a diverse group of people at many levels: labor, management, and customer. In addition to having a working knowledge of Spanish, I am fluent in Polish. Most of the projects I have worked on involved either remodeling or installing and repairing different kinds of roofing, both shingle and tar. Being quite familiar with the tools and machinery needed for tasks at hand, I will be able to inform and assist workers with any difficulties they may encounter.

My on the job experiences have led me to a firm commitment to providing a safe working environment, something which my coursework in Public Health and Environmental Science at Haclion University has reinforced. My experience and training will aid in the prevention of job-site accidents. In order to work fulltime and take a fulltime courseload, I have had to develop my organizational and scheduling skills, something which will further help me complete all sitework on time. As I have learned, staying close to or ahead of schedule is one of the best ways we can promote customer satisfaction and increase repeat business.

I have enclosed a copy of my resume that shows my work and academic experience. Please contact me at handygreg@cl.com to set up an interview. Larry Anthony of Local # 934 (888-009-5893) and Herb Chundley (888-009-7032) have offered to provide references for me. Feel free to call them. I look forward to hearing from you.

Sincerely,
Gregory J. Benjamin

GREGORY J. BENJAMIN

Haclion University
Campus P. O. Box 983
Forrest Glen, DC 88888
(888) 009-4708
handygreg@cl.com

OBJECTIVE: Seeking a supervisory position in the field of construction with emphasis on roofing and exterior remodeling.

ABILITIES:

- Skilled at organizing projects and estimating time of completion.
- Knowledge of all types of excavation and remodeling techniques.
- Experience in organizing productive crews for job sites.
- Skill with all types of saws and tools needed for repair and remodeling
- Proficient knowledge of Microsoft Excel and Microsoft Access.
- Experience in customer relations.
- Speaks Spanish and Polish
- Certified in CPR and Lifesaving since 1995.

EXPERIENCE: **Member of Labor Union #934, District of Columbia**

Herb Chundley Construction: *Fall 1993-Present*

- Remodeled homes and modular units, including the interior, exterior, and roofwork
- Organized separate projects according to time, amount of labor, and cost of materials and labor.
- Developed time-saving techniques while keeping a safe working environment.
- Organized extremely large project including the renovation of five multifamily homes.
- Organized large projects at multiple mobile home complexes.
- Supervisor of several large projects dealing with roofing and siding on several different style homes and other types of buildings.

EDUCATION: **Halcion University, Forrest Glen, DC** *Fall 1998-Present*

Public Health Major, GPA: 3.5 Major GPA: 3.92

- Courses in Environmental Science and Public Health
- Courses dealing with environmental hazards and precautions and also public safety and awareness.
- Attended several work safety seminars including jobsites located at DC Civic Center, Capitol Hill Complex, and Metro Recycling.

21 Cedarville Ave.
Piscataway, NJ 08940

May 7, 2001

Newton Manufacturing, Inc.
178 Technology Plaza
Fairfield, NJ 65746

Dear Director of Human Resources:

A posting in The Star Ledger on May 3, 2001 attracted my attention. I saw that your company desires to hire a systems engineer to develop models for more efficient manufacturing of products for the health industry. I believe my education and work experiences make me a strong candidate for the position, and I hope you will concur.

Later this month I will graduate from Rutgers University, School of Engineering with a B.S. degree in Industrial and Systems Engineering. During my four years at Rutgers, I have completed the full range of courses needed to begin a career. For your needs, two courses have special relevance. Production Control was a course where I learned that perfection is essential when the manufactured product is intended to remedy life-threatening illnesses. Simulation Modeling was another course of significant importance. In the class and lab, development of prototypes was done to prepare for actual manufacturing.

In conjunction with my course work, I have been working part-time for Audio Hearing Instruments for the past two years. The tasks I have been responsible for have given me practical experience in solving problems relating to worker efficiency and attention to details. In part due to my work, Audio Hearing Instruments is a highly respected manufacturer of hearing aids. Other work experiences I have had are not specifically in the manufacturing industry, but I have held laborer positions where I learned reasons why morale can drop and ways to improve worker morale and productivity.

I hope this letter and the attached resume persuade you that I am a strong candidate for the systems engineer position. An opportunity to meet with you for an interview for the position would be greatly appreciated. You can contact me by phone at (732) 555-1234 or by email: adamo@eden.rutgers.edu. Thank you for you consideration.

Sincerely,

Steven S. Adamo

Steven S. Adamo
21 Cedarville Ave.
Piscataway, NJ 08940
(732) 555-1234
adamo@eden.rutgers.edu

Objective

To obtain an entry-level position requiring strong analytical and organizational skills in a manufacturing engineering environment.

Education

Rutgers University, School of Engineering

B.S., Industrial and Systems Engineering, May 2002
GPA 3.65

Relevant Course Work

Manufacturing Processes	Production Control
Design of Engineering Systems	Manufacturing Facility Layout
Engineering Probability	Computer Controlled Manufacturing
Simulation Modeling	Quality Control/Design of Experiments

Computer Skills

Software: Microsoft Word, Excel, Access, Power Point
Micrografx, Stat-grahix, Arena/SIMAN, TK Solver
Languages: Fortran, C++

Experience

Dec. 1999 to Present
Audio Hearing Instruments, Manufacturing Support Group,
Manville, NJ
Industrial and Systems Engineer Intern
- Perform time studies for floor-plan design and assembly line layouts
- Designed fixture/tools for process improvement
- Manage process database
- Provide support to international facilities

Sept. 2000 to Dec. 2000
International Rope Connector
Senior Project
- Group leader of four person engineering team
- Design/constructed/tested universal connector
- Determined facility layout and process for mass production

May 1997 to Sept. 1999
Williams Lumber Company, Sussex, NJ
Truck Driver
- Delivered lumber and other building supplies to construction sites
- Developed communication skills

Awards and Affiliations

N.J. Science Scholar Award 1999
School of Engineering Scholar 2000
Association of Industrial Engineers

123 Castlepoint Terrace
Hoboken, NJ 07030

March 19, 2000

Dear Dawn Steinman,

I just recently reviewed your ad at Monster.com, and I noticed that you are requiring a responsible yet out-going individual to oversee your new cosmetic line in New York. Launching a new line requires an individual who is capable of dealing with the multiple responsibilities, such as make-up artistry experience, a willingness to learn new information, mathematical knowledge for placing orders and budgeting, managerial experience, sales experience, and most-importantly, a personality that is sociable as well as patient in order to build a new client base. I feel that I have the skills and experience that will be required of launching your line in New York.

Currently the counter manager for "Poppy", a budding Australian cosmetics line at Barneys, I have seen the initial difficulties that can come with launching an international cosmetic line, but I also know of the great satisfaction that eventually comes with overseeing the rise of success. With "Poppy", I have not only-built a strong clientele for the line by proving my abilities with the customers, but also with being personable. I am not only their make-up artist providing a service but also a friend. Having worked with cosmetics for a year and a half-now, I have gone from being a novice to an expert in the field - from working as a sales person, to working on movie sets, photo shoots and weddings. As in my resume, my mathematical skills were also put to the test with the two inventories I had to execute, as well as maintain an accurate stock book. I also assisted with the launch of another new cosmetics line at Barneys- "Cargo." As their resident make-up artist, I coupled my enthusiasm with my artistic ability to boost sales by 45%, as well as create a niche for a once unknown cosmetic line in New York.

My managerial experience in the customer satisfaction department at Warranty and Financial Products Inc provided me with the experience of being in a position of authority as well as improving my skills of responsibility. I learned the importance of being fair by managing a staff of 15 individuals, as well as solving customer-related problems through patience and understanding, which are important qualities to have in any managerial position. My skills in cosmetics as well as business are a unique combination that would prove useful in launching and overseeing your line in New York.

I would like to have the opportunity of interviewing with yourself in person, so that I may show you a photo-portfolio of my artistry work, as well as further my own knowledge of your line. I will contact you tomorrow to set up a date at your convenience.

Thank you for your time and consideration,

Candice Common

123 Castlepoint Terrace
Hoboken, NJ 07030
Home: (201) 123-4567

Candice Common

Objective

Seeking a fulfilling account executive position for a budding cosmetic company.

Experience

February 2000-Current Poppy Cosmetics Inc. New York, NY

Poppy Counter Manager

- Maintained a cosmetic counter at Barneys NY.
- Acted as a liaison between store buyers and cosmetic vendors.
- Established a strong niche for the new line by building a strong clientele list.
- Produced special events to promote sales and knowledge of the line throughout the department as well as with clients.
- Organized, prepared and executed the last two inventories.
- Responsible for a 30% increase in projected sales through makeovers.

October 1999-February 2000 Cargo Cosmetics Inc. New York, NY

Resident Make-up Artist

- Responsible for the professional application of make-up for all of Cargo's clientele at Barneys NY.
- Increased sales by over 45%.
- Built an extensive clientele list.

July 1999-October 1999 Estee Lauder Seattle, WA

Sales Associate

- Consistently ranked first as part of the sales staff at Nordstrom's.
- Assisted in cosmetic training and promotions throughout the department.
- Worked well in a team atmosphere.

March 1999-July 1999 Warranty and Financial Products Inc. Seattle, WA

Customer Satisfaction and Verification Officer

- Maintained customer satisfaction for this budding corporation.
- Ensured quality content of all sales from the sales staff through verification and data entry of customer information.
- Assisted in the training of 15 new individuals weekly.

Education

Fall 2000-Current Rutgers University *New Brunswick, NJ*

- Currently a pre-business major.

Fall 1998-Spring 1999 Southern Methodist University Dallas, TX

- Attended freshman year at the age of 16.

Chapter Four

Researching Your Topic

Students often have difficulty with the research aspect of the course because they do not understand some key terms. The lack of knowledge results in excessive hours of unproductive labor, and frustration over falling behind schedule for task completion. Research work is like any other task students encounter: knowing what to do makes the process as efficient as possible. Consequently, terms will be introduced in this section to establish the framework for the research that is needed for the course. First, **primary** and **secondary** research will be discussed. Then, the differences between **scholarly**, **professional**, and **popular** publications will be shown. Finally, the terms used to electronically access information in the Rutgers Libraries will be explained.

Types of Research

When you are thinking about a topic for your proposal, think about the way you will show that the topic really is important. It will not be sufficient to just rely on an emotional appeal that the problem needs to be funded. Research will be required to demonstrate the nature and extent of the problem. Your instructor may require primary research, secondary research, or a combination of both. **Primary** research means that you actively collect data about the topic. Surveys, questionnaires, direct observations with note keeping, and interviews are typical examples of primary research. Once compiled, the information can be presented in charts or graphs to quantify the problem.

Sometimes the problem is not local and does not lend itself to collecting primary research. In these instances, it is necessary to go to published sources to find evidence that the problem is significant. **Secondary** research is the term used to describe this search for published information, often but not exclusively found in libraries. For your proposal, you may do secondary research to introduce the problem, and you must do secondary research for the literature review of the paradigm. The question then becomes what should be looked for. The answer is that each proposal stands or falls on the quality of its research and all need a solid foundation of published and authoritative facts, studies, theoretical works, and other documents. Without published sources you will be very hard pressed to develop a paradigm.

Evaluating Secondary Research Sources

Whether you physically are in the library, electronically searching the library, or generally searching through the Internet, you need to question the authority and merit of the information. Three terms are key:

Scholarly sources are articles and research studies published in academic journals. They show what scholars in a particular discipline are thinking about topics of interest to them. In the scholarly journals, you will see that discussions take place within paradigms, accepted concepts and models for thinking about issues. The reading can be difficult because the contributors to these journals have shared beliefs and specialized vocabulary that someone outside of or fairly new to the discipline may not quickly comprehend. Realizing that these sources are the strongest authorities you will have for your proposal should help you persevere even when the reading is challenging. Scholarly sources are found in college and university libraries. Many journals are now in electronic form, but many are also still only in print form. When you access the Rutgers Libraries, you will see whether articles you need can be downloaded or whether you need to go to the library and photocopy the information.

Professional sources are publications such as newsletters, magazines, and some web sites that are used by the practitioners of a given profession or discipline. They include up-to-date information and discussion about existing and new products, business applications, and related topics. These publications also have advertisements for products and employment opportunities. As with scholarly publications, professional sources also appeal to special audiences. They are a good place to go to find how well the scholars' theories are actually working. These publications can often be found in the Rutgers Libraries or through Internet sources. Professional publications might also be found in the department office at the university for the topic under consideration. It is well worth making the effort to find these sources.

Popular sources include newspapers, magazines, and web sites that are readily available to the public. In print, popular sources are found on news stands, in supermarkets, book stores, etc. While they are the easiest sources to find, they have the least value when authority is being established for a proposal that requests funding. Popular sources can, however, supplement the scholarly and professional sources and show that the topic being addressed is of general social interest.

Based on this brief discussion of the three types of sources, students can see that the more easily obtained the information is, the more the authority of the source needs to be questioned. Each time a source is examined, place it in one of the categories and remember what was noted above: Each proposal stands or falls on the quality of its research and all need a solid foundation of published and authoritative facts, studies, theoretical works, and other documents. Without published sources you will be very hard pressed to develop a paradigm.

Finding Sources

Today there can never be the excuse that you "couldn't find any research" on something. You will see, in fact, that there is usually *too much* information on any topic. Just try a search on the ABI/Inform Index (from the Rutgers Libraries home page: http://www.libraries.rutgers.edu/) or run a search on HotBot and you'll see the quantity of information available. You must learn to be selective, have confidence in your ability to analyze what you read, and just simply get to work.

The best place to start is the Rutgers Libraries home page (address above), which can be easily referenced at any library computer terminal or via Netscape at any computer lab. If you are using a computer off campus, it can be set up to access the Rutgers Library. On the library's home page, click *Off Campus Support* for instructions. The library home page is set up for easy use, listing the **IRIS** Catalog (which lists all book and periodical holdings at all Rutgers Libraries), **Indexes and Data Bases** (which offer expansive bibliographic references, and sometimes full text, of articles in various fields), and **Research and Reference Gateway** (helpful guides to quality web sites prepared by Rutgers librarians).

The only way to learn how to use the library or its home page is by using it. If you have not used computers to search for information, now is your time to learn. It takes some practice, but there is plenty of help available. For one, there are tutorials to help you learn how to navigate through the options (Click *Instructional Tools and Services*). In addition, every section of this course has a library tour to familiarize you with the resources available at Rutgers. Third, class instructors can be of help to you since they are acquainted with many topic ideas and sources connected to those topics. Finally, remember the reference librarians. They are highly experienced faculty members. The library is their classroom; you are their students. Show them what you have done; ask them questions; seek their advice whenever you get stuck looking for information. The more specific your question, the better the help you will receive.

If you can't locate a source at Rutgers, you can order any book or journal article through interlibrary loan, often within a two week period. If you start your research early, you should be able to get all the information you need. Be careful, however, to continue your research efforts while awaiting that ordered source. The deadline for completing an assignment will not change if your ordered source does not arrive on time.

The research you do will lead to the completion of three tasks: The Annotated Bibliography, the Midterm Letter, and the Project Proposal. Stay focused on evaluating each source to ensure the proper balance between scholarly, professional, and popular publications. Follow your instructor's schedule for submitting assignments. By the end of the course, you should have researching skills that will be of value in future courses and workplaces.

On the following page you will find some general suggestions on searching the Internet. There is also a very good web page titled *Evaluating Information Found on the Internet* which should be checked. The address is <http://milton.mse.jhu.edu:8001/research/education/net.html>

Some Advice on Searching the Internet

You should never rely upon the internet as your main source of information. Internet sources tend to be too simplified and too much driven by self-interest to serve as the basis for your research.

You should always seek a wide variety of sources, using books for depth of coverage, peer reviewed journals for thinking in your field, and periodicals for timely coverage of recent events. The internet should be only a supplement to these sources. These suggestions are therefore intended to give you some ideas about using the internet as an assistant rather than a crutch.

- If you are seeking government statistics, check out "thomas" the government center for information at http://www.thomas.gov/. For New Jersey information, try http://www.state.nj.us/.

- An increasing number of statistical sources are available on line. You can also use Statistical Abstracts of the United States and Statistical Reference Index, which are available in the reference section of most campus libraries.

- If you are beginning with a broad subject (cancer, AIDS, alcohol, guns), try starting with the "web guides" prepared by Rutgers Librarians (accessible from the Rutgers Libraries home page at http://www.libraries.rutgers.edu). Use the guides to help narrow your topic and to get ideas. Keep track of successful search terms; they will come in handy later.

- If you have already narrowed down your subject a lot, or you know exactly what you want to work on for the project, then try a search engine like AltaVista or HotBot These sites will do a more comprehensive search than Yahoo and other classified search engines. For an even more comprehensive search, try a metasearch engine such as Dogpile or Meta-Crawler (http://www.metacrawler.com) to simultaneously search on several engines.

- If you're looking for a specific web site, often you can guess its address. Most begin "www," then a period, then the name or acronym of the site, then a period and the type of site. These types include "com" (commercial), "gov" (government), and "edu" (education).

- Develop a long list of keywords to search with and keep adding to that list as you go, trying to get more and more specific. Put a "+" before a word you want to include and a "-" before one you want to avoid. Put quotes around specific phrases, like "binge drinking." Usually a phrase will help narrow your search.

- Remember the basics of boolean logic: use "and" to narrow and "or" to expand categories.

If you find a good web site, see if it contains links to others or lists of references you can find in the library. Often, web sources are abstracted versions of much better journal articles or books. Go to the original source!

Finding the Right Numbers

Before you begin research for your project, consider the importance numbers will have in making your argument strong and convincing. In almost every component of your final project proposal, you will need to use numbers well. Unsuccessful proposals are usually weak because the writer has amassed a great deal of evidence, but is unable to use that evidence in a focused or directed way. Rather than plugging in any and all statistics that you can find on your topic, keep your ultimate goal in mind: gathering the right sort of compelling evidence and relating it to the needs and concerns of your funding source. You can save time and energy by focusing on key questions before you start looking for facts and figures.

- What is the level of expertise of the funding source? How much do they already know about the subject of the proposal? What are the most important statistics needed to convince them that this project is worth funding?

  Answering these questions can guide your choice of which statistics to look for or use. For instance, you would use a different level of specificity in addressing scientists at the National Institutes of Health than you would for a local school board or town council. You could also assume the scientists would have a fairly developed background knowledge of your topic; you couldn't count on that shared knowledge with a general audience.

- In order to quantify the problem in the Introduction, what are your best sources of documented evidence? Which groups or organizations might have already studied the problem? Which people have been most impacted by the problem and would therefore have the most information about it?

- In browsing through the abstracts of articles which may help you work within a paradigm, which ones show that a particular approach has been successful? In your Literature Review, you will have to do more than just report on what other people have done. You will have to demonstrate to your funding source that you have good cause to choose or reject the methods used by others, based on the numbers.

- What kind of project can reasonably be proposed to your funding source? What is your funding source's annual budget, and how much money to they have to work with each year? What size are the grants they usually give to people at your level of expertise?

  You can find this information by looking up the funding source in a Foundation Directory or by reviewing its website. If you are dealing with a local group rather than a grant-giving foundation, then find out as much as you can about it. Your project will be have a greater chance of success if you tailor your solution to what the funding source typically funds.

- Is your project realistic? Have you considered all of the ramifications of what you are proposing? Often proposal writers have great ideas that look good on paper; the problem is well-documented and the models and methods of the paradigm are sound.

However, the actual plan falls short because the writer is so focused on details that he or she does not consider the big picture. Sometimes using numbers well means looking beyond the numbers.

Here are some examples of questions that arise when a writer does not keep the real world in mind.

A ten mile levee on one side of a river may solve a flooding problem for one area, but what happens to the towns on the other side of the river if a levee is built?

Rerouting traffic in one area to solve a congestion problem may work, but where will the traffic go?

A daycare center may be desperately needed at a particular company, but if that company is laying people off and downsizing, this year may not be the best time to propose it.

Mandating a new addition to the curriculum for your old high school may be a great idea, but is there time during the day to fit in one more required class without displacing state requirements? Are there enough teachers to teach the new class?

Setting up a volunteer program to provide food, furniture, and clothing for women and families as they leave a battered women's shelter is a noble idea. However, it is almost a fulltime effort. Can you count on a coordinator who will work for free for indefinite periods of time?

- Are your budget figures accurate and as current as possible? Have you considered everything?

  Often writers want so much for their proposals to be accepted that they undercut the budget. Doing so will probably backfire when the project cannot be completed due to lack of funds. Since the directors of your funding source review many project proposals and have probably funded similar projects, they will realize if you are leaving items out. This will make you appear either unaware or unprepared. Either way, you weaken your project rather than strengthen it by underestimating a budget.

When You Can't Find the Numbers You Need

1. **Keep trying.** Often, especially with online research, key information is hidden behind the keywords that you haven't tried. For instance, say you are writing a project on making a community service project mandatory at a local high school. You need to find information about teens and community service or volunteering. A search in Statistical Universe using the keywords "teens" and "community service" or "volunteerism" will

get you nowhere. The perfect graph for your project can only be found under "surveys—opinions and attitudes, by age." Start early and be persistent. Don't do your research when you are pressed for time.

2. **Try extrapolating.** Often it is possible to take percentages from national studies and use them to make educated guesses as to how many people will be affected by an issue on a local level. In order for this to work well, your local population must be entirely typical with the rest of the larger area. For instance, if you absolutely can't find rates of smoking for your town, you could use state or local averages and then work out the equation. If 30% of people in New Jersey smoke, one could assume that 30% of people in Paterson smoke. However, if your local area is different in some significant way from the larger population, you should not rely on extrapolation. A town populated by a significant number of young families cannot be compared to a town with several senior citizen retirement villages. If you are reduced to documenting your local problem by extrapolating from national statistics, you must be honest about it and clearly show how you have arrived at the figures you are using.

3. **Fill in the gaps by surveying and questioning.** Sometimes a problem is so new or so local that there is not a large amount of hard data to draw from. In that case, you will have to do primary research yourself. As much as possible, make sure that your surveys are legitimate and convincing. Your sample size must be large enough and varied enough to be representative. The fact that twenty of your friends say they dislike Economics 101 is not good evidence that a university should drop the course. As you survey, keep track of what day and time you did the survey, how many people responded, how many of each gender, age, and so on, depending upon the subject of the survey. You should also ask your survey questions in such a way that they will generate good statistical responses. Which of the two statements below seems most convincing?

    - Fifty percent of the people I surveyed disliked Economics 101.
    - Out of 1,000 students, 50% stated that they ranked Economics 101 (on a scale of 1-10, 1 being the lowest) at 3 or below.

4. **Use uncertainty to your advantage.** Sometimes a lack of knowledge is the best evidence you have that a problem exists. Scientists use uncertainty all the time in order to show that more research must be done. If you are writing a research proposal, you should use the lack of statistical information as part of your documentation of the problem. Be sure to discuss the possible dangers or lack of opportunities that result from "not knowing." If you have an implementable project proposal, then perhaps discuss one of the advantages of the project as being a means of gathering more information about your topic.

A Brief Guide to Using APA Style

For most scientific writing, citation style as given by the American Psychological Association is used. You will need to know APA Style for both in-text citation and your bibliography; the following are guidelines based on APA recommendations as of April 2001. For more information on the intricacies of APA citation, consult the *Publication Manual of the American Psychological Association*, 4th edition (1994). For the latest on web reference, go to the frequently updated http://www.apa.org/journals/webref.html. The following examples of format are all based on those sources.

In-Text Citation

The main purpose of in-text citation is to link information in your text with entries on your bibliography page. For that reason, you need to make the connection clear by using the name or organization listed as the author in your bibliographic citation as the identifying reference in your text. If the source has no discernable author, then use the first few words of the title. The two pieces of information you **must** have in a textual reference are the name (or title words) and the year of publication. The American Psychological Association suggests that you include a page number (or paragraph number if no page number exists, as on a web source) if you are using a direct quotation from the text.

To make your sentence flow more easily, try to incorporate as much citation information into the actual phrasing as possible, as in this example:

> In a 1998 Hostutler University study, Miller found that ...

If you cannot include the citation information in your sentence, use parenthetical citation as follows:

> In a two year research project involving gametes, ... (Miller, 1998).
>
> In a 1998 research project at Hostutler University, ... (Miller).
>
> Miller (1998) published her findings on gametes ...
>
> A 1998 research project on gametes shows that... ("Gametes," 2000)
>
> The article "Gametes" (2000) is required reading at Hostutler University.

Here are the rules on citing multiple authors, taken from the APA's 1994 Publications Manual, pages 168-169. You should refer to the manual for more specific information if needed.

- When a work has two authors, always cite both names.
- When a work has three to five authors, cite all authors the first time. From then on, use the first name on the list, followed by et al.

- When a work has six or more authors, use the first name followed by et al.

On your references page, you should always include all of the authors of a work.

A note on non-accessible sources:

Since the whole purpose of including citations and references is to provide your reader with the means of finding the same sources themselves for future research, you should not include the following as part of your bibliography: e-mail, personal interviews, phone communications, references to non-published lectures or speeches, and surveys or other original research you have done gathering information about the problem you are addressing in your proposal. You should, however, mention them in your text. Follow the guidelines of your instructor about which sources you can and cannot include on your bibliography page.

A survey of 100 biology students at Hostutler University on April 1, 2001 produced some interesting results.

In an interview on January 12, 2001, William Regan, head of the United States Department of Astrophysical Phenomena, discussed the possibility of neutrino bombardment.

W. Regan (personal communication, January 12, 2001) discussed...

Bibliographic entries:

Your bibliography should be double spaced consistently throughout, even within entries. Do not skip extra space between each entry. You must list your sources in alphabetical order, either by the author's name or the title. If you have two or more sources by the same author, list them by date of publication, earliest first (APA, 1994, p. 179). Do not number your entries on the page—alphabetical order and indentation will separate one entry from the next. There are some key differences between APA style and the MLA style to which you are probably more accustomed. For instance, only the first words of a title and subtitle are capitalized, unless the word is a proper noun. Only the first initials of an author are used. The year always follows the author (or the title, if no author is known). The following examples will give you some idea of format; for more complete information, consult the APA Publication Manual or the APA website.

A book:

Smith, G. (2000). *Care of the horse: A practical guide.* Atlanta: Myrado Equestrian Press.

A book with no author:

Care of the horse: A practical guide. (2000). Atlanta: Myrado Equestrian Press.

Part of a book:

Moroney, K. (2000). Keeping saddles in optimum repair. In G. Smith (Ed.), Care of the horse: A practical guide (pp. 75-84). Atlanta: Myrado Equestion Press.

A brochure:

(If the author is also the publisher, just write "author" after the place of publication.)

American Astrophysical Association. (1998). *Quantum reality and you* [Brochure]. Washington, DC: Author.

Periodicals:

(If the periodical is paginated continuously throughout the year, only the volume number is needed. If each issue begins with page 1, include the issue number after the volume number.)

Muzzey, E. J.,& Muzzey, W. D. (1999). The environmental impact of restoring New Hampshire barns. *Environmental Journal, 15*, 329-354.

Regan, W., & Frederick, E. H. (2001). The frequency of the diapason stop: Measuring a non-imitative sound. *American Organ Society, 47* (3), 9-18.

Miller, C. J., Gibison, N., Roney, N. J., & Maguire, M. (1996 Winter). Mitigating the effect of sibling distance. *New Jersey Family Studies, 24*, 3-27.

Newspaper:

(If the paper is not nationally known, include the place of publication in brackets.)

New study promotes health among the middle-aged. (2000, July 14). The Recorder [Catesville, PA], p. A7.

Denisewisz, L. (1998, December 24). Marching backwards: my years in a fur headpiece. *The New York Times*, pp. C14-C15.

Entry in an encyclopedia:

Frederick, E. H. (1995). Herbert Howells. In *The Empire Encyclopedia of Musicology* (Vol. 7, pp. 43-44). Northfield, MN: Firetower Academic Press.

Government documents and other reports:

American Guild of Skywatchers. (2001). *Meteor showers in the Chesapeake Bay area.* (AMASAS Publication No. AGS 10-4396). Washington, DC: U.S. Government Printing Office.

An unpublished, in-house document:

Brown, M. (1997). *Log of daily accounts.* (Available at Bryan Dentistry, Westerly Place, West Park, NY 02984).

Articles found on a CD-ROM or electronic database:

(Record your source as you would a printed source, adding "retrieved from xxx database, CD-ROM, release date, item no. if available, web address if appropriate. Do not include a period at the end of your entry after a web address.)

American Guild of Skywatchers. (2001). Meteor showers in the Chesapeake Bay area. Washington: DC: U. S. Government Printing Office. Retrieved from ASTRO database (ASTRO Sky Reporter, CD-ROM, Spring 2001 release).

Evenson, N. (2000). Interest in humanities among biotechnology students. *The Journal of Midwestern Studies, 14*(9), pp. 46+. Retrieved March 27, 2001 from EBSCO database (Masterfile) on the World Wide Web: **http://www.ebsco.com**

Smith, G. (1997, September 7). Finding the write formula. *The New York Times,* 12 para. Retrieved December 29, 1998 from Elixier database on the World Wide Web: **http://www.elixier.com**

Web References:

(If you are only referring to a website in general, and not a specific article or page on the site, you can just record the name and web address in your text. You do not need to include a bibliographic entry for it.)

For referring to documents on the web, please check the APA website listed above. For most web documents, you can use the same format as non-web sources, but you then need to add "Retrieved Month Day, Year, from the World Wide Web: http://etc.org/whatever.html" Please be sure to list the web address of the actual article or page you are using, not the address of the website you accessed first. Do not expect your reader to be able to follow you through all of the links you clicked to find the article.

Muzzey, E. H. (2001). Biochemical reactions in toddlers: The effects of television on the lymphatic system. *Journal of Northeastern Medicine, 36*, 90-123. Retrieved April 7, 2001 from the World Wide Web: **http://www.jnm.org/journal/muzzey/23000.html**

Sample Annotated Bibliography

An annotated bibliography is simply a bibliography or reference page to which notes (annotations) have been added after each entry. The main information required is a statement or two summing up the source and its usefulness for your project. You might also want to say whether you will be using the source to quantify the problem your project is attempting to alleviate, or whether the source will be help you as you set up the research paradigm for your project.

References

Bocamazo, L. M. (1991). Sea Bright to Manasquan, New Jersey: Beach erosion control projects. *Shore and Beach, 59*, 37-42.

This paper shows beach control projects that have been used in New Jersey in the past fifty years. It will help me decide the best method for stopping the erosion at Bayport. Although not all of the projects deal with a similar ecosystem, there may be some which will function as models for my own.

Jackson, N. L. (1996). Stabilization of the shoreline of Raritan Bay, New Jersey. *Estuarine Shores: Evolution, Environments, and Human Alterations, 17*, 397-420.

Seawalls are discussed in this article, along with other methods of alleviating the same problem. This will help me decide if a seawall would be helpful at Bayport, and if so, will help me determine what height the seawall should be.

Nordstrom, K.F. (1989). Erosion control strategies for bay and estuarine beaches. *Coastal Management, 17*, 25-35.

A seawall alone may not be enough to control the erosion and sea level problem at Bayport. The seawall combined with other structures and techniques to hold back the sea would be a strategy I might consider, and this paper presents models used along bays like the Tranry Bay. Additional control structures will probably be needed.

Thorstein, G. (2000). *Land-sea barrier methods*. New York: Putnam.

This book will help me design a good plan for alleviating the effects of sea-level rise in Bayport. Thorstein's failure analysis of methods which did not work well will be useful for me in avoiding unsafe or unsuitable designs. Since he includes many sample projects carried out in areas similar to Bayport, I can use them to develop an approach based on an existing paradigm.

Chapter Five

Two Paradigms for Wildlife Management

The following two project proposals are interesting to compare because they are shaped by different paradigms of wildlife management and thus propose very different plans. We hope that comparing these papers can lead to fruitful discussion of the paradigm concept and its importance in developing your project.

Proposal for Management of White Tailed Deer

This proposal opens with a combination of primary and secondary research to show the seriousness of the problem. The literature reviewed carefully examines strategies for managing deer populations. Based on the models reviewed and their applicability to the area under consideration, a well-conceived plan is proposed which shows that humans and deer can benefit from implementation of the plan.

996 Baxter Drive
Bridgewater, NJ 08807
December 11, 2000

Bob McDowell, Director
New Jersey Division of Fish and Wildlife
P.O. Box 400
Trenton, New Jersey 08625-0400

Dear Mr. McDowell:

Thank you for attending my oral presentation entitled "Measures for Deer Management in Bridgewater Township." With the news of a recent fatal accident, the problem in Bridgewater Township has risen to a new level. The local papers sported headlines such as "Bridgewater's failure to act costs man his life." The time to address this issue is now. A final draft of my proposal to address the deer population problem is attached.

Over the past twenty years several methods have been explored to thin deer herds in overcrowded areas. The most effective method that receives the least amount of opposition is the use of contraceptives. Porcine Zonae Pellucidae (PZP) has been studied many times; it has been proven time and again to be safe and effective.

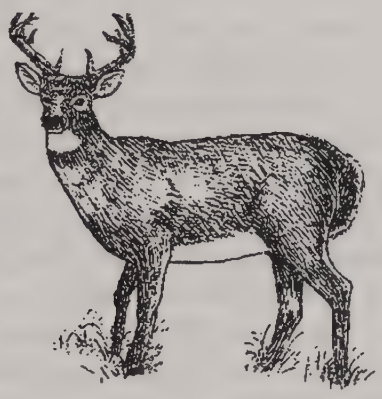
Establishing an Animal Control Office to conduct annual portable thermal imaging studies will enable Bridgewater to obtain an accurate estimate of the deer population throughout the township. Following up the count with PZP injections biannually to half the herd will effectively reduce the population within five to ten years. Since the problem of deer overcrowding is not unique to Bridgewater, the success of this program will serve as an example for neighboring communities.

Thank you again for all of your time and support. Please feel free to contact me at the above address with any questions or concerns. I look forward to working with you in the future.

Sincerely,

Name deleted

Measures for Deer Management in Bridgewater Township



Source: Robert Savannah, US Fish and Wildlife Services

Submitted to: New Jersey Division of Fish and Wildlife
P.O. Box 400
Trenton, New Jersey 08625-0400
Attention: Bob McDowell, Director

Submitted by: Writer's Name Deleted

Submitted on: December 11, 2000

Abstract

This proposal delves into the deer population problem that exists in Bridgewater Township and offers methods of solution. The estimated deer population densities in portions of the township exceed three times the carrying capacity of the land. The health of the deer is declining, and the residents' concern is increasing due to Lyme disease and deer-related car accidents. Research shows that with an accurate estimate of the deer population problem an effective method of control can be developed and implemented; portable thermal imaging is the means of obtaining this accurate estimate. Over the past twenty years several methods of control have been studied including legalized hunting and contraception. Legalized hunting, however, has generally been dismissed as a solution due to safety concerns. Several contraceptives have been explored and found to be useful. Porcine Zonae Pellucidae (PZP) has shown the most promise for thinning deer herds due to its effectiveness and lack of associated health problems. Research also suggests that a delivery rate of 50% be implemented to see results in a reasonable amount of time. By delivering PZP injections to half the estimated deer population in Bridgewater Township, the herd can be reduced to an optimum level within five to ten years.

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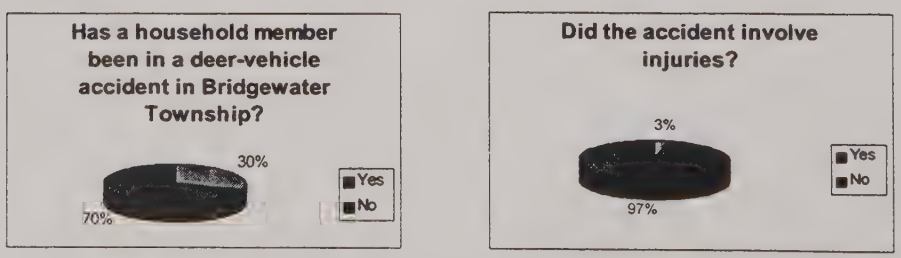
Introduction

Over the past twenty years the amount of open land space in Bridgewater Township has dwindled due to an increase in residential and commercial development. As a result of the decrease in open land a deer population problem exists. The deer are being forced out of the woods and into residents' backyards causing concern for safety and health.

The estimated carrying capacity of an oak forest habitat is in the range of 10 deer/km^2 (Sams, Lochmiller, Qualls, & Leslie, 1998). The conditions that exist in the majority of Bridgewater Township can be loosely translated as an oak forest habitat. However state officials suggest 8 deer/km^2 (or 20 deer/mi^2) is safer for areas as heavily populated as Bridgewater Township (Yang, 2000). According to the latest published numbers, the deer population in the township is estimated as at least 1,600 deer in the township's 33 square miles (Needham, 1999A). This population density corresponds to at least 48 deer/mi^2, which is more than double the suggested number. In arriving at the calculated density figure the assumption was made that the deer population is evenly spread over the entire township. Unfortunately, this assumption is not realistic. In reality certain portions of the township are experiencing deer population densities up to 70 deer/mi^2. This number is in excess of three times the carrying capacity of the land.

Nearly four years ago when Bridgewater Township first looked into the problem of deer overpopulation a survey was mailed to a sampling of 1,000 residents. The following results were obtained for deer-car related accidents in Bridgewater Township (Yang, 2000):

Figures 1 & 2: Bridgewater Poll Results



The results from the poll show that of the 670 households that responded to the survey, about 30% had a household member involved in a deer-car related accident within the township. Of those accidents 3% involved injuries. The results of the survey also indicated that the average estimated damage to vehicles was $1,788.

The residents of the township are concerned about the problem surrounding the deer. The deer pose a safety risk to them in terms of the Lyme disease they spread and the potentially fatal car accidents they cause. The township also has reason to be alarmed due to the liability of such fatal accidents. The eating habits of the deer have also ruined the aesthetic quality of most of the township. Due to the overpopulation the deer are forced to eat any food they find including flowers, shrubs, and trees that adorn residents' lawns and township property.

It is clear that a problem exists relating to the deer population in Bridgewater Township. The local officials are looking into a solution but making no real progress as is outlined in Appendix 1: Timeline of Deer-Related Events. Through careful consideration of available methods and associated paradigm discussion a plan can be developed and implemented. The next several pages will delve into the paradigm surrounding deer population management.

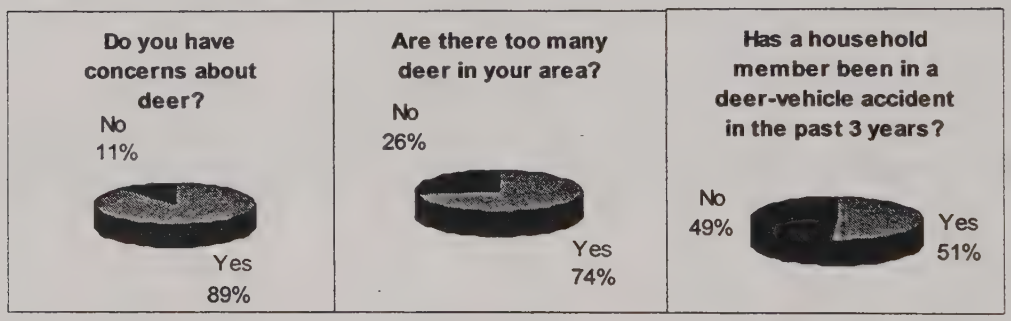
Literature Review

The Human Factor...

The excessive deer population has taken its toll on the citizens of the township. The increase in deer population has brought a rise in the cases of Lyme disease, which is an inadvertent infection of humans with an animal pathogen (Barbour, 1993). The carrier of this disease is the Ixodes scapularis tick for which the deer serve as host. Over the past ten years New Jersey has risen to 4th in the nation in number of reported cases of Lyme disease (Kaplan, 2000). Residents of the township fear for their safety from this potentially debilitating disease. One resident was quoted in the local paper as saying "I have children all around me that can't play in the backyard. If I get sick or hurt by one of these deer, I'm coming after the township." (Morella, 2000).

In a study conducted last year at the Flemington Fair, the following attitudes toward deer and deer populations were reported (Needham, 1999B):

Figures 3-5: Flemington Poll Results


Do you have concerns about deer?
No 11%
Yes 89%
Are there too many deer in your area?
No 26%
Yes 74%
Has a household member been in a deer-vehicle accident in the past 3 years?
No 49%
Yes 51%

Although these figures are not specific to Bridgewater Township, they are representative of attitudes in New Jersey. The problem of deer overpopulation is not unique to Bridgewater Township. It is a problem that persists in much of the state and is impacting the quality of life for residents.

The Deer Factor...

In addition to the impact the overpopulation has on human residents, it also has negative effects on the deer residents of the township. Over the past twenty years the portion of the township inhabited by humans has drastically increased. This leaves less and less acreage for the deer to inhabit and decreases their quality of life.
In a study done by Leberg and Smith (1993), the effects of deer population density on deer growth were explored. It was determined that when densities are high enough to

reduce the quality or abundance of food, the growth, fecundity, and survival of deer are decreased. Leberg and Smith (1993) determined that most especially for males, as population density increased the length of growth period increased and the asymptotic mass decreased. Sams et al. (1998) conducted a similar study into the effects of population density on deer herds. Their findings were in agreement with Leberg and Smith (1993). This study concluded that high-density populations suffered from nutrient deficiencies, increased parasitism, and presumably social stress. These factors have a negative impact on growth as well as the survival of the herd. The incidence of tick infections with the Lyme disease tick was increased in the high-density herd studied by Sams et al. (1998) and led to a higher mortality rate in fawns.

Understanding the Problem…

Sams et al. (1998) state, "Understanding the relationship between density and environment is essential for successful management of white-tailed deer herds." An understanding of this relationship can be found through literature review. Gill, Thomas, and Stocker (1997) state, "the reliability of deer population management could be improved with good density estimates." The only unknown factor for the successful management of the herd in Bridgewater Township is an accurate estimate of density throughout the entire township. Previously reported numbers were merely rough estimates.

Gill et al. (1997) conducted a study on the use of portable thermal imaging for estimating deer population density. The findings of the study included the fact that many more deer could be determined through the use of thermal imaging at night as compared to roadside counts in daylight. It was also determined that the use of thermal imaging created little disturbance to the deer. The accuracy of the deer densities determined using thermal imaging was fairly accurate when compared to population models.

Methods of Control…

One of the first methods of deer management explored was the use of hunting. This method was quickly dismissed. The reasons for dismissal included the need for strict safety regulations as well as lawsuits raised by animal rights activists (Thompson, 2000; Tucker, 1999).

The focus has shifted to more animal-friendly methods of deer population management such as contraception. A study conducted by Seagle and Close (1996) used the GAPPS II individual-based population simulation system to model the effects of contraceptive rates and immigration on deer herds. It was determined that population management programs using contraception delivery rates below 50% may be ineffective at either curbing growth or decreasing population size even at low levels of immigration. An inoculation rate above 50% would be needed to effectively manage the deer population at an optimum level.

Types of Contraception...

Over the past ten years several types of drugs have been explored for use as deer contraception. Among the drugs explored were porcine zonae pellucidae (PZP), melengestrol acetate (MGA), and levonorgestrel (LNG). Several studies have been conducted to determine the best choice for deer contraception.

White, Warren, and Fayrer-Hosken (1994) conducted a study that focused primarily on the use of LNG rods implanted in deer. The conclusions were that LNG was not effective as a deer contraceptive at the levels tested with three of the five adult females implanted becoming pregnant the first year. The study went on to conclude that the use of LNG also carried health problems in deer such as voluntary reduced food consumption. Plotka and Seal (1989), comparing the use of LNG and MGA, also concluded that LNG was ineffective for deer contraception. This same study indicated that MGA was successful in preventing pregnancy for up to two years. However, MGA had adverse effects on does implanted mid-pregnancy. Only one of five implanted does delivered a live fawn. Considering the fact that a goal of deer contraception is to not interfere with already pregnant does, MGA does not prove to be a valid choice for contraception.

PZP thus far has proven to be the contraceptive of choice for deer. It works by inhibiting fertilization through the blockage of sperm binding sites on the ovum by anti-PZP antibodies (Turner, Kirkpatrick, & Liu, 1996). In the study conducted by Turner et al. (1996) PZP was administered in three methods. None of the does that received the first method of three separate PZP injections produced a fawn in the first year. The same was found for does that received the second method of two separate injections. The third method was a single injection along with implantation of a mini-pump designed for continuous release. Of the single injection fawns 20% reproduced the first year. In the second reproductive season there was little difference between the control does and treated does in reproductive rates. This finding by Turner et al. (1996) indicates the reversibility of PZP as a contraceptive.

A similar study into the possibility of PZP as a deer contraceptive was conducted by McShea et al. (1997). The results of this study were similar with no offspring production the first year in the two-dose group and 78% of the one dose group reproducing. In the second year a booster was given to the one dose group, which reduced reproduction rates to 22%. Again the study determined that a one-dose method of administering PZP was ineffective as contraception in deer. The two-dose method proved to be effective for up to two years.

Research indicates that PZP administered in a two-dose method is most effective for use as contraception in deer herds. The PZP did not pose risk to does when administered mid-pregnancy. The methods used in the studies by McShea et al. (1997)

and Turner et al. (1996) showed no adverse reaction by the does. The does appeared to be in good physical condition and no differences in breeding were observed between treated and untreated does (Turner et al., 1996). McShea et al. (1997) did observe that the treated does were more active and breeded for a longer cycle.

It is evident that deer population management has received much attention in the past several years. The research clearly indicates that a good management plan starts with an accurate estimate of the problem and follows with aggressive actions. These aggressive actions can include the use of the contraceptive PZP due to its safety and effectiveness. The next section will expand upon the paradigm to develop a management plan that is unique to the situation in Bridgewater Township.

Procedures

Objective: The objective of this project is to develop and implement an effective and aggressive course of action to reduce the deer population of Bridgewater Township. To achieve this objective, a two-phase plan is proposed. The first phase is to accurately estimate the extent of the problem. The second phase is to implement a strategy to reduce the deer herd to an optimum level.

Phase One

1) Township Council Meetings

It is essential that this plan meet approval from the township. In an effort to get the township involved, the plan and all associated issues must be discussed with the township ahead of time. The Township Council holds meetings every first and third Monday of the month. Deer management is a hot topic in the township. Therefore it shouldn't be difficult to make our way onto the agenda. The project should be brought to the township in the beginning of the year to ensure enough time to enact the plan by July.

Issues to be discussed at these meetings include the allocation of funds, township approval, and volunteer support. It is expected that the township will work with the New Jersey Division of Fish and Wildlife to share expenses; Bridgewater Township has been budgeting numbers for deer management for some time now. Due to the fact that this plan suggests nonlethal methods of control the township should be receptive to the plan.

Since residents attend these meetings a plea for volunteer support can be made during the meetings. Hot issues also gain a lot of attention through the local newspaper. The township animal shelter made a recent plea for volunteers through the newspaper, which generated a good turnout. The media attention that this plan generates can be used to obtain volunteers.

2) Animal Control Office

Bridgewater Township currently has a Wildlife Management Advisory Committee to address the issue of deer control. It is evident that this nine member volunteer committee is not fully capable of developing and implementing an effective solution. An Animal Control office needs to be established. This office would be merged with the existent Advisory Committee to combat the problem together.

A three member paid staff will be established to run this program. A full-time Animal Control Officer will be hired to run the Animal Control Office. A full-time veterinarian and two part-time veterinary assistants will be hired to aid in the hands on

animal procedures as well as for their knowledge. This hired staff will be supplemented with the volunteers from the Wildlife Management Advisory Committee and any other volunteers that come forth.

3) Portable Thermal Imaging

For this portion of the plan I call upon the research reported by Gill et al. (1997). The use of portable thermal imaging proved useful in obtaining an accurate estimate of deer population density. The assertion was made that this type of count was only valuable in areas where the deer have become accustomed to human interaction and thus have become quite tame. As a resident of Bridgewater Township I can certify that this is just the case.

The Somerset County Emergency Services Training Academy will run programs in the use of portable thermal imagers. The course will last six hours for one day. The trained members of the Animal Control Office will conduct annual portable thermal imaging throughout the township by a combination of foot and vehicle counts between the hours of dusk and dawn. These counts will take place after the birthing season and before the mating season.

Approximately 70% of the township's 33 square miles can be covered by vehicle counts and the other 30% must be done by foot. On average it takes about 0.39-man nights/km^2 to perform the counts by vehicle and approximately 0.78-man nights/km^2 to perform the counts by foot (Gill et al., 1997). It will take approximately 20 nights of foot counting and 23 nights of vehicle counting to cover the township. By using two teams simultaneously the township should be covered in a month at most.

Phase Two

1) PZP Injections

Based upon the research outlined by Turner et al. (1996) and again by McShea et al. (1997), PZP in a two-dose method has been chosen as the contraceptive to be used in Bridgewater Township. PZP has been shown to be effective for up to two years, which cuts down on the number of times the does are handled. It was also shown that PZP poses no major health hazard for does, which makes it easier to gain public support.

Seagle and Close (1996) suggest that a delivery rate of 50% be used to effectively manage the deer population at an optimum level. A higher delivery rate may quickly reduce the herd but will pose long-term problems by eliminating an entire generation. It is based upon this suggestion that half of the does counted by the thermal imaging in phase one be inoculated with PZP. It can be assumed that the buck to doe ratio is approximately one to one.

Before any injections take place the members of the Animal Control Office are to consult with those who are familiar with deer control. The members of the Animal Control Office can gain valuable insights from those who have been through this experience. Two good resources are Susan Martka, a regional deer biologist from the northern district of the NJ Division of Fish and Wildlife and the officials from Assateague Island who have been using PZP for years to control their wild horse population.

According to the latest counts approximately 400 does will need to be injected with PZP prior to mating season. This number could change drastically after the completion of phase one. Each doe will receive two shots of PZP spaced three weeks apart. The veterinarian and the veterinary assistants will deliver the injections via dart to the hip region of the doe. The does will be inoculated in the wild since capture is both time-consuming and expensive. Due to the acclimation of the deer with humans the staff should have no problem getting close enough to administer the injection.

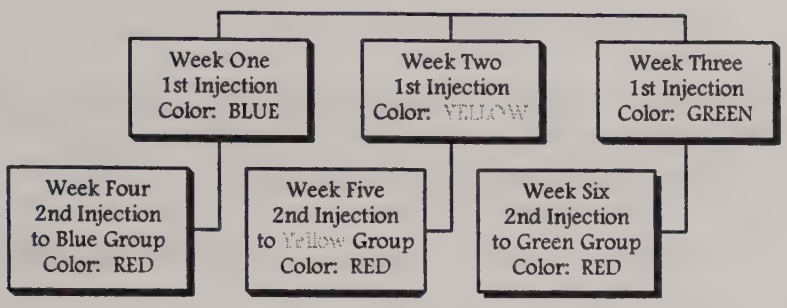
The thermal imaging of phase one will indicate the areas of Bridgewater Township with the greatest population densities. The staff will first concentrate on these areas for administering the PZP injections. The deer will be located by walking through the forest areas during daylight hours. If not enough does are found during daylight the injections may need to be moved to night when the deer are more active.

2) Identification

Since the does are inoculated in a two-dose method identification of those previously inoculated becomes important. Not all does will be inoculated during the same week. The first round of inoculations will be spread over a three week time period.

At the time of the first injection the doe will be hit with a color-coded dye to identify the week in which the doe was first inoculated. The second injection will be accompanied with a red dye to indicate that doe as being fully inoculated for two years. The following figure details the color-coding system for the six weeks of injections. The first week will be in the beginning of October and the sixth week in mid-November. This schedule ensures that all inoculations will be complete by the start of mating season.

Figure 6: Color-Coding Flowchart



Ideally the dye should be administered through the same mechanism as the PZP to ensure that proper identification occurs. The dart guns used may be capable of administering the dye to stain the fur as well as the PZP for contraception. If it becomes apparent that this is not possible the dye may need to be administered separately with a blowgun. This second method is a last resort since it must be perfectly coordinated. The doe may be startled by the dye or the PZP and move before the other is administered.

3) Yearly Deer Counts

The Animal Control Office will continue to conduct annual portable thermal imaging counts throughout the township. These counts will enable the office to establish the effectiveness of the program. The need to inoculate more does or the need to cease the program and dissolve the animal control office will be determined from the count results. Throughout this project the members of the Animal Control Office will also continue to attend the township meetings to keep the township board and residents informed of the program's progress.

Schedule

January 3, 2001	Bring proposal to the township at biweekly meeting.
January – May 2001	Continue to discuss plan with township including allocation of funds, township approval, and volunteer support.
February 2001	Hire staff for the Animal Control Office.
May 2001	Make plea for volunteer support through local newspapers.
June 2001	Purchase two portable thermal imagers.
July 2, 2001	Staff to attend training course for portable thermal imaging at the Somerset County Emergency Services Training Academy
July 3 – August 10, 2001	Conduct vehicle and foot counts throughout the township.
August – October 2001	Consult S. Martka and officials from Assateague Island.
August 1, 2001	Place order for dart guns, darts, and colored dyes.
August 15 – 30, 2001	Train in the use of dart guns.
September 2001	Place order for appropriate amount of PZP.
October 1, 2001	Start with first round of PZP injections.
October 22, 2001	Start with second round of PZP injections.
November 12, 2001	Finish PZP injections.
November 2001 – June 2002	Continue to meet with township officials to discuss progressof the plan.
July 2002	Conduct annual portable thermal imaging count.
August 2002	Determine the need to increase or decrease the number of does.injected next year.
September 2002	Continue to meet with the township officials to discuss plan
May 2003	Improvements.

This schedule will repeat for the duration of this program with minor adjustments.

Budget

The budget for this project is itemized below. The costs are divided into six primary categories: Thermal Imaging, Salary, Office, Transportation, Communication, and Contraceptive. Since this is a government office the cost of office space is negligible; the office will be located in a township owned building. The use of volunteers is a negligible salary cost as well.

Thermal Imaging Costs — $ 40,200

- Purchase of two thermal imagers @ $20,000 each
- Six hour training course on use @ $200

Salary Costs — $115,272

- Full-time Animal Control Officer @ $25,731
- Full-time Veterinarian @ $66,143
- Two Part-time Veterinary Assistants @ $11,699 each

Office Costs — $4,800

- Computer @ $1,200
- Printer @ $700
- Cordless Phone with Answering Machine @ $150
- Fax Machine @ $140
- Two Desks @ $80 each
- Four Chairs @ $50 for a set of four
- Filing Cabinet @ $60
- Paper and Other Miscellaneous Supplies @ $200/month

Transportation Costs — $ 6,688

- Lease of a 2001 Mercury Mountaineer AWD for 36 months @ $299/month and $1,799 due at inception from Flemington Car & Truck Country Dealerships
- Geico Insurance and Registration @ $1,600

Communication Costs — $ 1,690

- Office Phone Bill from Verizon@ $100/month (including installation)
- Three Nextel Phones @ $100
- Service Plans @ $190 month

Contraceptive Costs $202,260

- PZP prepared by M. Bernoco for About 400 Does @ approximately $500 each
- Three Dart Guns by PneuDart Inc. @ $399 each
- 402 Darts @ $6 for 15 darts by PneuDart Inc.
- Colored Dyes @ $58 by PneuDart Inc.

TOTAL PROJECT COST $370,910

The contraceptive costs are a general estimate at this point. The true amount depends on the numbers obtained from phase one of this project. The actual contraceptive costs could be considerably more or less than the budgeted amount.

The total cost reported for this project is the first year start-up cost. The second year costs would be significantly less. The reasoning is that PZP is effective for two years thus the second year costs are cut by two-thirds with the loss of the contraceptive costs. There are also certain start-up costs that will only be incurred the first year. An accurate second year figure would be about $100,711. The third year figure would be about $302,971. For the duration of the program the annual costs would fluctuate between these two figures.

Justifications

- Office Costs: The establishment of the Animal Control Office generates certain costs. These costs include the purchase of office equipment and supplies that are essential to the running of a successful office. All office supplies will be purchased from Staples.com.

- Transportation Costs: The use of portable thermal imaging and PZP injections creates a need for transportation. These costs include the lease and associated costs for one Sport Utility Vehicle for field use.

- Communication Costs: To be effective the members of the office must confer with each other and other knowledgeable sources. The communication costs include the cost of office phone service and the purchase and use of three Nextel phones. These Nextel phones enable the members of the office to instantaneously confer while in the field.

Discussion

This deer management plan has all the elements of a successful plan as outlined through research. The benefits of such a plan are enormous and four-fold. The deer, the residents, the township, and the New Jersey Division of Fish and Wildlife all benefit from the results.

The deer benefit from a more abundant and higher quality diet due to less competition for food. As a result of better food conditions the deer will be able to maintain normal growth, both in height and weight. The deer will also experience less parasitic infections and a lower mortality rate (Sams et al., 1998). The thinning of the herd will lower the number of deer that will venture out of the open spaces and into residents' backyards.

The decrease in deer population will help restore the quality of life for residents as well. A successful deer management plan has been proven to aid in the reduction of Lyme disease (Barbour & Fish, 1993). The decrease of deer in close proximity with residents will quell the fears of injury due to Lyme disease or deer-related car accidents.

The township will benefit by a decrease in deer-related accidents that pose a risk liability for Bridgewater Township. Less competition among deer for food should help restore the aesthetic nature of residents' property and township property. Residents will be able to confidently adorn their property will flowers and shrubs. The decrease in residents' concern will also benefit the township; the township council will be able to focus their attention on other important issues.

The New Jersey Division of Fish and Wildlife will benefit from this plan as well. At this point in time the organization's mission "to protect and manage the state's fish and wildlife resources to maximize their long-term economic, recreational, and biological values for the citizens of New Jersey" is being challenged with the excessive white-tailed deer population that exists in Bridgewater Township. This plan, which adheres to the agency's goal to "maintain species diversity and optimum density of the state's fish and wildlife populations," will accomplish the mission of this agency.

The plan I have developed is a self-evaluating project. Through the annual deer counts conducted in the township the project progress can be closely monitored. These counts indicate a need to increase the number of PZP injections or the need to decrease injections and ultimately end the program. The success of this program will serve as an example for neighboring towns with a similar deer population problem.

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Appendix

Table 1: Timeline of Deer-Related Events (Yang 2000)

Date	*Event*
May 1996	Deer Study Task Force has its first meeting
August 1996	Task Force plans to randomly mail 1,000 surveys to township residents for opinions
October 1996	Task Force mails surveys
November 1996	Results from 670 surveys are in (see Figure 1)
March 1997	Task Force hires private contractor to conduct deer counts by helicopter
June 1998	Task Force reports its findings after two years that a bow-and-arrow hunt is the best way to thin the herd
July 1998	Standing-room-only council meeting draws proponents and opponents of the proposed hunt
October 1998	Public hearing draws about three township residents and more than 20 out-of-towners including several animal-rights activists
November 1998	Second public hearing draws about 100 people with more public hearings proposed
December 1998	Hunting ordinance is introduced, but Mayor Dowden refused to support it unless its terms and costs are precisely spelled out
February 1999	Hunting ordinance is withdrawn Council considers testing a dart that will induce abortion in deer and considers a public hearing to gauge residents' opinion on the abortion dart
April 1999	Council decides to involve the state, county, and neighboring towns in its search for answers
August 1999	Council revises its deer-control plan, dropping the proposed hunt and calling for nonlethal methods of control Vote on the watered-down proposal is postponed
November 1999	Council approves an ordinance that will establish a Wildlife Management Oversight Advisory Committee
February 2000	Advisory Committee holds its first meeting
October 2000	Advisory Committee's interim report recommends sending a questionnaire to residents, suggesting that a "localized neighborhood approach" is best
November 2000	Nearly five and a half years after the council began discussions on deer control the only deer being killed are those involved in car accidents such as the one

2000	involved in an accident that also took the life of a Bedminster man

Proposal for Management of Feral Cats

This writer of this well-researched proposal takes the general feelings of the Mantoloking citizens into account. Although the writer knows that most feral cat management strategies call for culling their numbers drastically, he realizes that he must deal with cat lovers who are against euthanasia. In order to save the plover, he develops a plan for the cats that allows for adoption and sterilization rather than automatic euthanasia. He also makes the possible consequences of not reducing the cat population clear—phrasing it in terms of lost beach replenishment dollars from the state.

Xx xxx xxxxx xx
Xxxxxx xxxxx, xx xxxxx
December 11, 2000

Richard Ramirez
Borough of Mantoloking Zoning Office
202 Downer Ave.
Mantoloking, NJ 08738

Dear Mr. Ramirez:

Enclosed please find a proposal dealing with the declining piping plover population in New Jersey and the role that feral cats have played in this decline. Currently action is being initiated on all administrated levels to address plover decline. As a municipality slated for federal beach replenishment, the borough is required to enact a beach nesting bird management plan. Failure to do so could mean cancellation of the project, which could result in considerable economic impact to the borough. For these reasons I think that you will find my proposal interesting.

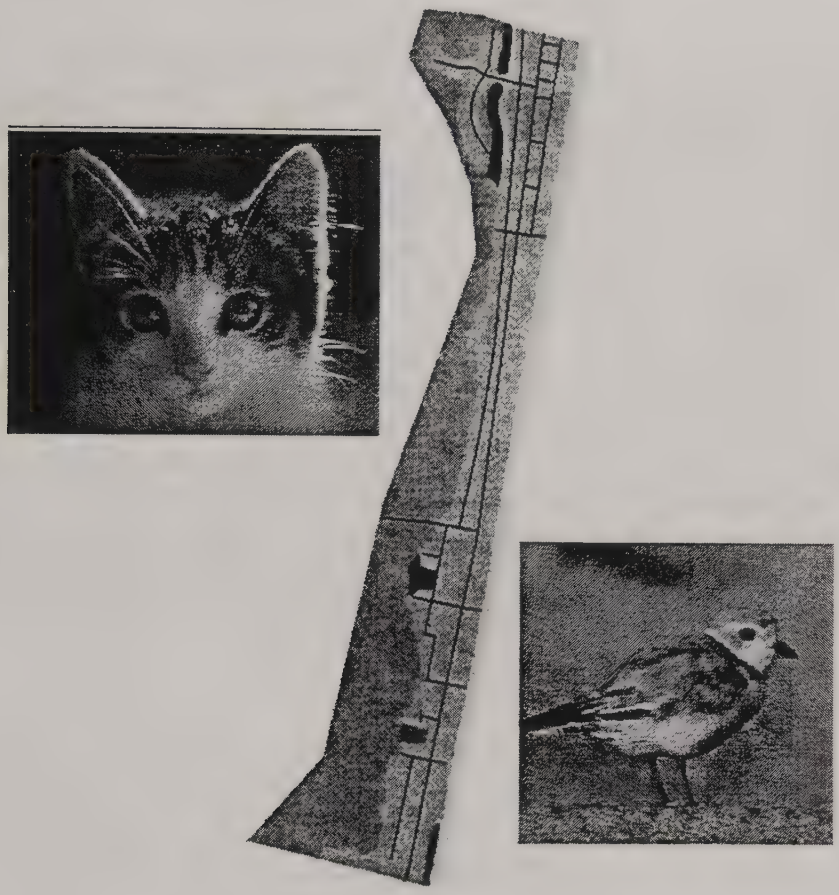
The wildlife management field has traditionally dealt with feral cat problems through exclusively lethal control methods, drawing the ire of the animal rights community, which has advocated non-lethal control methods. My proposal seeks to integrate the two approaches, minimizing the use of lethal methods early on, and eventually phasing them out altogether. I believe such a proposal will garner increasing support from the animal rights community, increasing the possibility for success of the project. The success of this project as well as efforts statewide will go far in reversing the current downward trend in New Jersey's piping plover population. This will eliminate the possibility of federal scrutiny of current local beach management, which could result in negative economic impacts to the borough. I look forward to discussing this proposal further with you. I can be reached at the above address, at (xxx) xxx-xxxx, or e-mail me at xxxxxxxxx@aol.com for any further discussion. Thank you for your time and consideration.

Sincerely,

Joseph X.. Xavier

Feral Cats and the Piping Plover

A Management Plan for the Borough of Mantoloking



Submitted by:
Joseph X. Xavier

Submitted to:
Planning Board of the Borough of Mantoloking
Submitted on:
December 11, 2000

Final Proposal for Scientific and Technical Writing
If found please return to:
Barbara Hamilton
English Department
Rutgers University

Abstract

Recent evaluation by NJ Division of Fish, Game & Wildlife of the status of the piping plover shows steady population decline statewide. Feral cat predation has been identified as a significant factor in this decline, especially in intensely developed areas. A statewide plan is needed to address the decline to prevent more intense control of public beach use and the accompanying negative economic impacts. Beachfront municipalities such as Mantoloking must be active participants in such a plan. Current literature regarding the control of feral cat populations is divided. The wildlife management community advocates lethal control methods, drawing criticism from animal rights and veterinary medicine communities, who support the use of non-lethal control methods. The proposal seeks to combine the two methods to attain an immediate population decrease while at the same time seeking support from the opposing communities for the later stages of the project. Also included in the proposal are legislative and educational initiatives enacted in an effort to prevent continued recruitment of new cats into the current population. The plan will satisfy Mantoloking's obligation under the Endangered Species Act to enact a beach nesting bird management plan and contribute to the statewide recovery of the piping plover.

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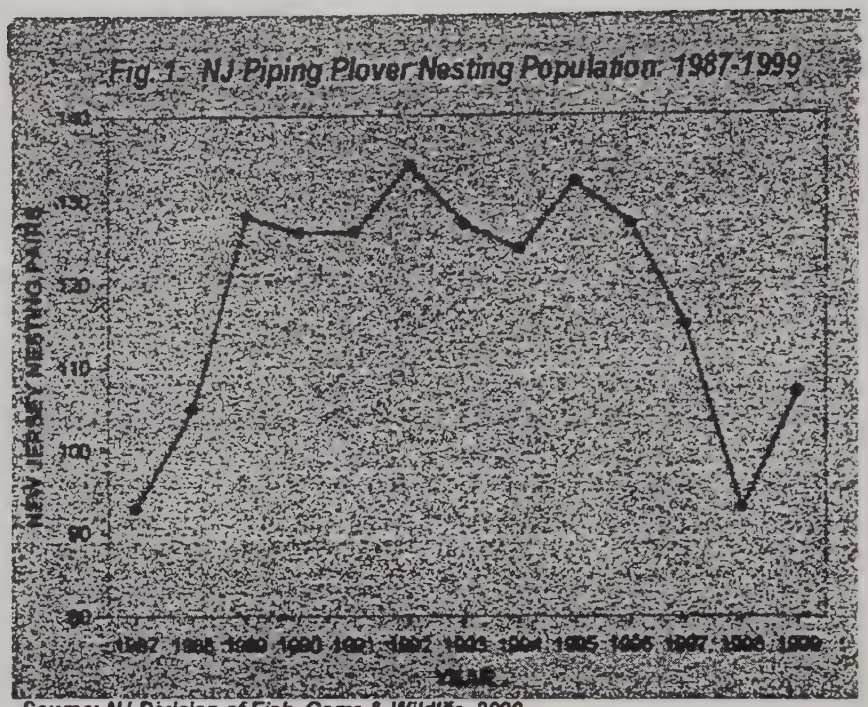
Figure 4: Causes of Piping Plover Nesting Failure: 1995-1998.....2

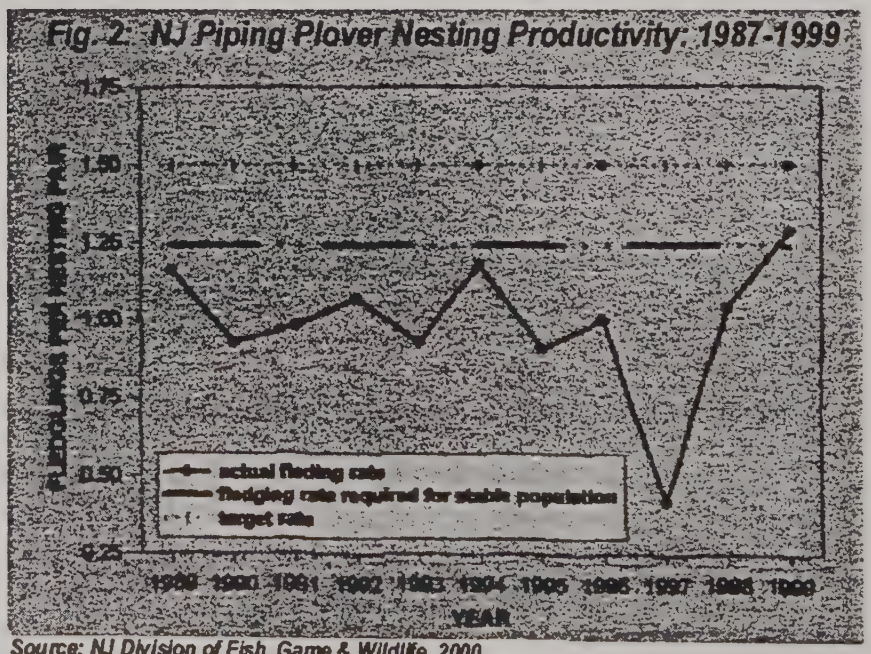
Introduction

The piping plover is a New Jersey resident beach nesting shorebird. It is currently listed as endangered by the New Jersey Department of Environmental Protection and as threatened under the Federal Endangered Species Act. In recent years, the New Jersey population has been in decline. Statewide, the population has declined from 134 nesting pairs in 1992 to 107 pairs in 1999.



Source: NJ Division of Fish, Game & Wildlife, 2000

On a local level, the total nesting pairs in Mantoloking has declined from 8 nesting pairs to 1 pair in the same time period (Jenkins & Niles, 2000). These numbers represent an eleven-year low in the population of piping plovers in New Jersey. Jenkins & Niles (2000) identify the New Jersey target recovery level, based on federal goals for the New York-New Jersey region, to be 200-230 nesting pairs.



Source: NJ Division of Fish, Game & Wildlife, 2000

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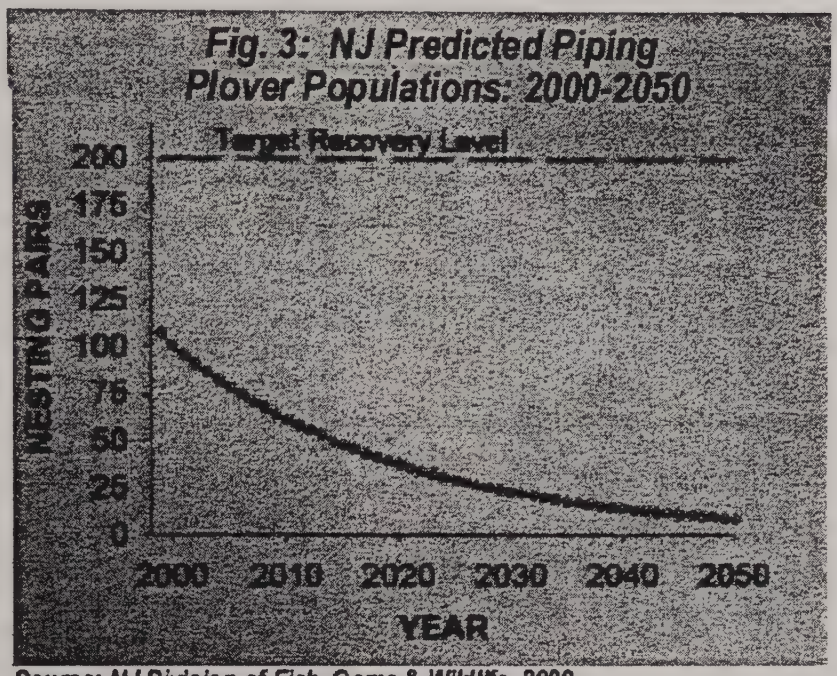
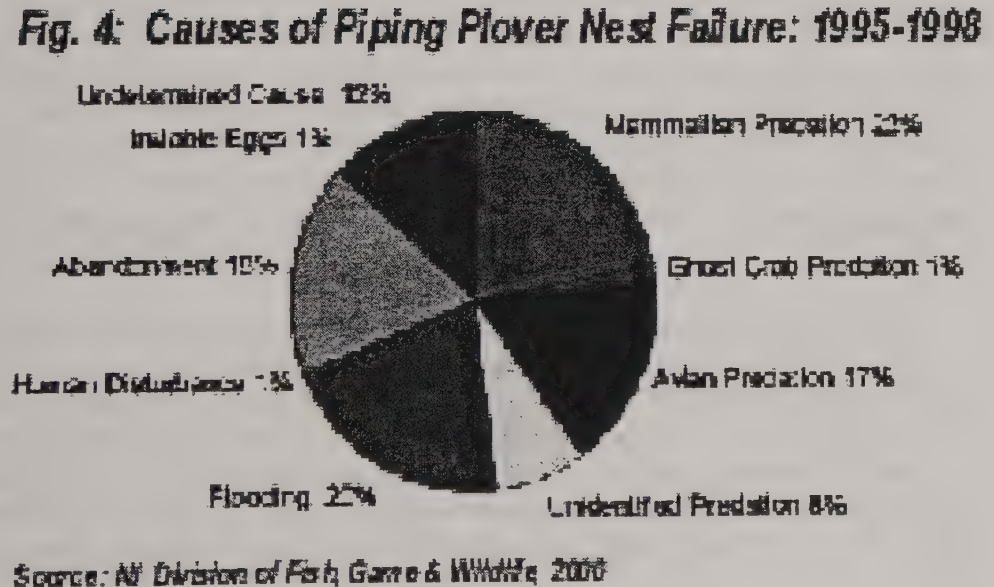
A major factor in the decline of piping plover numbers in New Jersey has been nesting success. The number of fledgling raised per nesting pair dropped to a low of 0.37 in 1997 from a high of 1.20 in 1994. During this same time period, the percentage of pairs nesting successfully dropped from 72% to 42%. Jenkins & Niles (2000) cite an unpublished 1994 report by Melvin & Gibbs stating that a fledgling rate of 1.24 is required to maintain a stable population. Jenkins & Niles (2000) go on to state that the fledgling rate needed for population growth is 1.50. Although nesting productivity rose dramatically from 1997-1999, it is well below the threshold required to reach the target population level. If the current negative trend continues, the piping plover may be extirpated from New Jersey in the next 50 years (Jenkins & Niles, 2000).



Source: NJ Division of Fish, Game & Wildlife, 2000

The causes of nest failure in New Jersey are varied, but predation has been identified as the primary cause. Nest predation accounts for close to half the nesting failures in New Jersey. In addition, it is estimated that a



Source: NJ Division of Fish, Game & Wildlife, 2000

large portion of unknown nest failures as well as at least half the abandonments involved predators (Jenkins & Niles, 2000). Mammals make up the largest part of nest predation, accounting for close to half of all nest predation. Primary mammalian predators have been identified as red fox and feral cats (Gerson, 1990, Patterson, et al., 1991, Jenkins & Niles, 2000). In New Jersey, Jenkins & Niles (2000) identify fox predation as occurring primarily on undeveloped beaches, with feral cats taking a more prominent role in developed shore communities.

In addition to extirpation of the piping plover, failure to address the declining piping plover population has regulatory and economic implications as well. Since the plover is protected under the Endangered Species Act, failure to meet federal target population levels could mean federal scrutiny of local beach management practices, leading to increased restrictions of beach use during the nesting season. The nesting season of the piping plover runs from April to July, overlapping with the tourist season. Further beach restrictions may have potentially severe economic impacts to New Jersey shore communities. Participation in beach replenishment projects could also be jeopardized. The Endangered Species Act requires municipalities participating in such projects to develop management plans for beach nesting shorebirds. Failure to do so could mean the prohibition of the municipality from participation in the program, which could result in negative economic impacts.

It is clear from the described situation that predator control (in the case of Mantoloking, feral cats) is required to prevent the extirpation of the piping plover from New Jersey. To allow this to happen would not only degrade the character of the New Jersey shore and the natural heritage of the state, but may also have severe economic implications as well. For these reasons, it is imperative that action be taken on a variety of administrative levels to reverse the current negative population trend and avoid the problems that a continuing population drop will cause.

Literature Review

Feral cats are not thought to have a particularly significant effect on wildlife, except in specific situations. The effects of cats on wildlife are particularly devastating on islands, but can have similar effects on mainland wildlife as well (Patronek, 1998). Mainland effects occur when island criteria apply. The Wildlife Society (2000) extends the term "island" to mean islands of habitat surrounded by development or degraded and unsuitable habitat. This is an accurate description of the beach of Mantoloking. Cats also have a particularly devastating effect on ground nesting birds such as the piping plover (Patterson, et al., 1991).

Exacerbating the problem of feral cat predation are the societal attitudes regarding the abandoning of unwanted animals, and the high fecundity rate of domestic cats (Mahlow & Slater, 1996). These animals exhibit a staggering potential for reproduction. Olson & Johnston (1993) estimated that 2 cats, producing 8 kittens per year, could produce as many as 174,760 cats. The best practical example of the reproductive potential of domestic cats is that of Marion Island, a sub-Antarctic territory of South Africa. In 1949, 5 cats were introduced as pets. This population ballooned to an estimated 2,139 by 1979 (Bloomer & Bester, 1992). Well-meaning members of the public can also keep cat numbers artificially high because of the feeding of strays (Coleman & Temple, 1993). While it might be thought that cats that are fed prey upon wildlife less, this is not the case. Liberg (1984) found that despite supplemental feeding, cats continue to hunt prey.

Methods of Feral Cat Population Control

Various lethal and non-lethal methods have been used to control unwanted predators. The wildlife management community has long favored lethal means. Short, et al. (1997) describe common lethal control means including spotlight shooting, trapping with leg-hold traps, hunting with dogs, and poisoning with the compound sodium monoflouroacetate (1080), and goes on to declare poisoning as the most effective of these methods, particularly in rural and wilderness areas. These methods present a problem in more developed areas, however. Hunting and shooting are impractical in residential areas, and poisoning presents the possibility of the mistaken poisoning of pets. Another lethal method of control more suitable for developed areas is live trapping, followed by euthanasia (Mahlow & Slater, 1996). In addition to being more humane, this method allows for possible adoption of cats deemed suitable, decreasing the extent to which lethal methods are required.

The primary drawback with using exclusively lethal means is that a sufficiently low number of cats will not last for any extended period of time. High fecundity allows any cats remaining to repopulate an area in a relatively short amount of time. In addition, removal of cats creates a population vacuum that allows any cats from adjacent areas to move into the area in question (Zaunbrecher & Smith, 1993, Mahlow & Slater, 1996). Public opposition is also a drawback of the use of lethal methods. In addition to opposition from animal rights groups, the recognition of cats as pets enflames opposition from the general public as well (Patronek, 1998).

Non-lethal methods of control are preferred by the animal rights and veterinary medicine communities. These methods are used to stabilize rather than reduce the population. Zaunbrecher & Smith (1993) found that a continuing program of neutering and release of feral cats can stabilize and eventually reduce a colony of feral cats through attrition. Sterilize and release programs assume that these cats play an important ecological role by occupying an empty predator niche (Mahlow & Slater, 1996). Cats undergoing sterilization are then released at the location of original trapping. In addition to stabilizing populations, Mahlow & Slater assert that this method also reduces common nuisance behavior such as roaming, spraying of urine, and fighting.

Contraceptive medications are a rarely used method of feral cat control in the US. Common contraceptive medications used in dogs and other animals have not been approved for use in cats. The use of such drugs would also present logistical problems in instituting a plan for use. Permanent sterilization is generally the desired method of control in feral cats. It would be a very rare scenario where contraception would be the desirable method of control (Mahlow & Slater, 1996).

Non-lethal methods have the advantage of being more palatable to the public. Continued public opposition of lethal methods requires a more widespread use of non-lethal methods of cat control. Unfortunately, there are situations where non-lethal methods alone will not bring about the reduction of cat numbers required. Where an immediate reduction in cat numbers is required, some lethal method of control would have to be used.

Legislation and Education

Any population reduction program cannot achieve full effectiveness without a change in public attitudes toward feral cats. As mentioned before, the root of feral cat problems begin with societal attitudes regarding both feral cats and cats in general. Animal control ordinances have traditionally focused on dogs, again the reason being societal attitudes viewing dogs as more dangerous (Mahlow & Slater, 1996). Certain laws such as licensing and leash laws that were originally intended for dogs should also include cats. Licensing gives municipalities an idea of the number of pet cats present, which allows a better estimate of the number of strays. Other legislative remedies suggested by Mahlow & Slater (1996) include differential license fees for sterilized and non-sterilized animals, expansion of the term "owner' to include guardians and caretakers of feral cats, and mandatory sterilization of all owned and stray or feral cats.

Public education may be used to make legislation more effective by changing public attitudes towards cats, but is often low on the list of priorities in such programs. This is because results of educational programs can be slow and difficult to measure qualitatively (Mahlow & Slater, 1996). Patronek (1998) and the American Bird Conservancy (2000) stress the need for public education regarding the responsibilities of pet ownership and the hazards that free-roaming cats can present to themselves, humans, and wildlife.

Proposal

The borough currently has a contract with the Humane Society animal shelter in Forked River for animal control. All further animal control resulting from this proposal can be implemented in conjunction with the shelter. Currently, animal control in Mantoloking is implemented at the request of borough residents. This proposal offers a more aggressive approach to animal control.

The plan proposed integrates lethal and non-lethal control methods, as well as legislative and educational plans. The proposal aims to reduce the use of lethal means as much as possible Unfortunately, lethal methods of control are required early on in the project, due to the present status of the piping plover. An immediate reduction in feral cat numbers is required to alleviate the current negative trend in plover numbers. Lethal methods of cat control are the only way to achieve this. There is only one lethal method that is practical in the Borough of Mantoloking, that being the live trap/euthanasia method. This method also allows trapped cats to be evaluated for adoption suitability. All those cats deemed suitable will be put up for adoption. It is estimated that there are approximately 50-70 feral cats in the Mantoloking area. The use of trapping/euthanasia would be a one-time action and remove 40 cats from the population. This will leave 10-30 cats in the population, a suitable level for stabilization through the use of non-lethal means.

When the desired cat reduction is attained, trap/sterilize/release will be used to stabilize the remaining population. This portion of the proposal would be ongoing, and attempt to sterilize the remaining population. Continuing vigilance regarding this phase of the proposal is necessary to treat any new cats entering the area. Marking of cats by the notching of an ear is required to identify previously sterilized cats. A continuing program of trap/sterilize/release should be effective in stabilizing and eventually lowering the feral cat population once the population is reduced to a less dangerous level.

To prevent human behavior that leads to further recruitment of cats into the area, legislative and educational plans are to be implemented. The borough council will be lobbied to implement the following ordinances.

- Licensing to be extended to include cats.
- Control/restraint laws such as mandatory leash laws and anti-roaming laws.
- Limits on the number of cats owned
- Sterilization-related ordinances.
  - ✓ Differential license fees.
  - ✓ Intact animals permit requirement

The proposed legislative remedies cannot be effective without educating the public as to why they are important. Such education must begin with the borough council to get the ordinances passed in the first place. Thereafter, pet owners and the public at large must be educated concerning the new laws. In addition, the responsibility of pet ownership must be covered, as well as the hazards posed by free-roaming cats. Such an educational plan already exists and can be implemented at minimal cost. The America Bird Conservancy's Cats Indoors Program provides a wide variety educational materials, many are available for downloading free of charge on their web site. Educational pamphlets are available for cat owners for a small cost. These pamphlets will be distributed to cat owners upon licensing of their cat(s). Downloadable materials available include fact sheets concerning local cat ordinances, the hazards of allowing cats to roam free, cat predation on birds and other wildlife and information on how to keep a cat happy indoors. The program also provides materials for print and broadcast public service announcements. The Cats Indoors program is endorsed and participated in by the New Jersey Division of Fish, Game & Wildlife for use throughout the state, especially in the shore region. This is an important aspect of the educational plan. Only widespread use of such a plan will allow a sufficient change in attitudes on the regional scale required to prevent further addition of cats into the feral population.

7

Budget

The following budget represents the amount required over and above the present animal control contract the borough now has with the Humane Society Animal Shelter in Forked River. Animal transport and euthanasia is included in the current contract. All boarding and sterilization may be done through the same shelter at additional cost. The boarding costs are for 7 days cats to be euthanized, as required by law.

- 10 Havahart Traps @ $41.79.....$ 417.90
- Boarding Costs ($28/cat).....$ 980.00
- Neutering (10cats @ $45).....$ 450.00
- Spaying (10 cats @ $65).....$ 650.00
- 500 'Cats Indoors!' Brochures.....$58.00
- Project Oversight (6 mos, 20 hrs/wk)..... $5800.00
- Monthly Monitoring (6 mos).....$720.00

First Year Total.....**$9,075.90**

Second year monthly monitoring cost is $1,440.00.

Continuation of non-lethal portion of the project after the first year is estimated to cost $300-$400 annually.

8

Discussion

The project will be intensely monitored during the first 6 months to ensure the proper number of cats is permanently removed from the population. Care must be taken to make sure the number removed is sufficient, but also to ensure that too many are not removed and unnecessarily euthanized, giving further ammunition to those that would protest the program. The intense monitoring would continue through the non-lethal phase of the program until it runs its initial course. After the intense monitoring period, estimated to be 6 months, monthly monitoring will begin.

During the next two years, monitoring will be twofold. Overall success of the program will be evaluated by continuing to monitor the change in population. Also monitored will be the number of new cats entering the area due to the vacuum effect. If the population remains stable or drops, no further action other than continued use of trap/sterilize/release to handle new cats would be required. Significant rise in the population may mean a return to euthanasia temporarily to reduce the population to the maintenance level.

Outside monitoring is not required for the legislative and educational components of the proposal. Educational materials should be distributed to cat owners in perpetuity. As previously mentioned, it would be very difficult to measure the effectiveness of the educational component. Legislative monitoring and enforcement is best left to local authorities.

Review of the literature shows that the individual components of this proposal are effective in achieving their desired results. Although lethal and non-lethal control methods have not been integrated in the past, their individual effectiveness is well known. Integrating these methods will allow for immediate and lasting reduction of the feral cat population, allowing increased nesting success in the piping plover. This should lead to increased plover numbers, thus avoiding any negative economic impacts that plover recovery failure would cause.

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Chapter Six

The Midterm Assignment

The Assignment

Write a 5 page letter or memo, single-spaced, that accomplishes the following:

- takes the form of a letter to an organization or person with whom you are not affiliated, or a memo to someone within your organization;
- addresses a specific person in that organization, by name;
- details and attempts to quantify a recent trend, problem, or need that concerns your reader's organization;
- provides an idea of how your idea responds to that trend, problem, or need;
- references your research clearly (according to APA Style)
- strives to create a clear consensus view (paradigm) that justifies your approach;
- closes with an invitation to your oral presentation (specifying time and place);
- and appends a bibliography of at least eight sources, cited in APA style (remember, though, that at least ten sources are required for the final paper)

The midterm paper should be written as a **letter of persuasion**, and as such it carries the added burden of addressing a particular reader and using some of the means of persuasion available to you for appealing to him or her (with special attention to rational or logical appeals).

Requirements

The midterm paper will be graded according to how well it does the following:

- Adheres to proper memo or letter form (according to the context).
- Discusses, documents, and tries to quantify a recent issue, problem, or trend.
- Highlights the reader's concerns about that topic.
- Cites specific facts and examples from your research that suggest a paradigm.
- Briefly proposes a plan and provides a rationale for it.
- Convinces your reader to hear more.
- Provides a bibliography of sources in APA style.
- Is well proofread for errors and appearance.

The letter should highlight the problem, paradigm, and plan of the project, and should offer a strong rationale for your idea based on authoritative research.

Purpose

The midterm paper serves many purposes:

- As a draft of the final paper, it provides you an opportunity to organize your research toward a practical goal and to begin presenting your information clearly.

- As an evaluative tool, it allows you to receive feedback on your work thus far, so you can have a sense of where you stand in the class.

- As an institutional requirement, it gives your teacher an opportunity to confer with the course coordinator on how best to assist you in your research and how to grade your work.

- As an exercise in persuasive writing, it gives you practice in the most valuable form of writing for business.

Typical Pitfalls and Problems

Students typically go wrong on the midterm paper in the following ways:

- they do not address a specific person capable of funding the project
- they fail to provide evidence of the problem or trend they seek to address
- they fail to make explicit references to their research
- they assert things without evidence
- they fail to attach a bibliography of sources
- they use insufficient or inappropriate sources
- they are poorly proofread for errors

Some General Advice, or "14 Steps to a Strong Sales Letter"

You have already gained some practice in writing the letter of persuasion when you wrote the cover letter with your resume. Here, you are also making a sales pitch, but in a much more detailed way.

Generally, I don't recommend following a formal approach to the midterm letter, or any letter for that matter. But there are about fourteen things you may want to consider as you write. These are stated as rules, and some are always good rules to follow. But obviously each situation should dictate the type of approach you take. Also, these ideas should not limit your creativity. Remember that the audience should always dictate your approach. Who will read your letter? What are your reader's concerns and interests? How can you appeal to this reader most powerfully? The answers to these questions should guide the way you write the sales letter, and they will always vary from situation to situation. With that in mind, though, accept these 14 pieces of advice.

1. **Know your audience.**

   Knowing your audience might require some preliminary research or leg work. If you are responding to a specific request for a proposal (commonly called an RFP), then you will know what your audience expects. But in this class, you will usually be addressing someone you do not know so well. Find out what you can. What is the corporate culture like at your reader's organization? What is their motto or corporate philosophy? What image do they project in their advertising? What recent endeavors have they undertaken? What problems are they facing? What is their competition up to? Find out about your reader's general interests so that you can know better how they might fit with your idea. What specific benefits can the individual or organization you plan to address gain from solving the problem or responding to the trend you are considering?

2. **Get the right name, and get the name right.**

   Address your letter to a specific person whenever possible -- and, for the purposes of this class, ALWAYS. How many times have you seen a letter that opens, "Dear Sir or Madam"? Does that inspire much interest in you? Not only is a letter addressed to a specific person bound to generate a more positive response, it will more certainly be read -- and it will more likely be read by that specific person capable of making a decision on your project. (The success of annoying ads like Publisher's Clearinghouse is due in no small way to the appearance of personal interest: even the most cynical readers are unconsciously and unavoidably flattered by the fact that Publisher's Clearinghouse knows their name).

   How do you find out the person to whom you should address the letter?

   This is another one of those "legwork" things, but fortunately these days it doesn't require any walking around: usually a simple telephone call or a "visit" to the company web site is all you need.

   When in doubt, just ask! Call up the company and ask a secretary or receptionist. Talk to a few people -- maybe even speak to the person you plan to address (that will give you a better sense of his or her style and will provide a good introduction to your letter). Just ask, and be nice about it. Who would handle the sort of project you have in mind? What department? What person in that department?

   Once you know who you should address, find out how you should address that person. How do you spell his or her name? How is it pronounced? Does she prefer Ms. or Mrs.? Is there a middle initial? A Jr., Sr., or Roman numeral? Find out.

3. **"Dear" is never wrong as an address.**

   "Dear" is the expected mode of address. Though you may have struggled in personal correspondence over whether or not to write "Dear" to your reader, in business correspondence it is simply a standard formality.

4. **Make a strong first impression.**

   How you open your letter will depend upon the specific audience and the specific appeal you want to make. If you know the addressee, you will likely want to remind him or her of that fact and allude to your most recent or most positive interaction. If you don't know the addressee personally, you'll have to be more creative. You can rarely go wrong by trying to open with a confident and definitive statement, and you should open emphatically whenever possible. Point to the problem or need you seek to address, or state the sort of vision you will provide in responding to this need. Get this person to read further.

5. **Show that you identify with your reader's concerns.**

   Explicitly state what you know about your audience's interest in the idea you will propose or the problem you seek to solve. Show that you can see things from the reader's perspective, and that you see the proposal as a win-win situation.

6. **Quantify or specify the problem or need you seek to address.**

   If you can quantify the problem, you can show its magnitude and importance. Alternately, you might give an anecdote or example that helps highlight the importance of this problem to your audience.

7. **Get to the point.**

   There are some cases where you may wish enigmatically to string your reader along before revealing your specific project. Usually, though, readers in business don't have time to read a mystery novel. So don't keep your reader waiting too long for your discussion of how you intend to solve the problem or respond to the recent trend you have identified. If you offer a deal, be up front about it. What are you offering? What do you want in return? Give your reader a forecast of what to expect.

8. **Provide evidence or examples.**

   This is the key to a successful letter for this course. You must cite your research. You must also show that you can use the information you have collected to construct an effective argument for action. You might say that it requires putting information in action. Evidence is always logically persuasive.

9. **Activate your reader's imagination.**

Invite your reader to engage with your idea, perhaps by using rhetorical questions. Get your reader to participate in your text.

10. **Encourage empathy.**

Now that you have shown your reader that you see things from his or her perspective, start to turn the tables a bit. Get the reader to identify with your reasons for being involved in this project, and present your reasons in the best light possible. If your ethos is key to your appeal, you may consider highlighting it earlier in your letter. For example, if a writer were trying to improve laws having to do with drunk driving, she might reveal early on in the letter that her brother was killed by a drunk driver.

11. **Close with a call to specific action or further contact.**

Make sure that the reader sees this as a pressing need, with a deadline for action. For the purposes of your sales letter for the class, you might invite your reader to hear your presentation, listing the specific date, place and time.

12. **Make contact easy.**

It is always a good idea to provide a way for your reader to contact you easily, either by phone or e-mail. Don't forget to put that down, usually in the last paragraph -- especially if it isn't clearly printed on the stationary you use.

13. **Sign off "Sincerely."**

Don't get fancy with the closing address, unless it is especially appropriate to offer "Best wishes." Like "Dear" at the outset, "Sincerely" is the standard close.

14. **Follow up and be persistent.**

Many times you will discover that your letter has languished in the wrong department or that a busy addressee has failed to take any action because the letter has gotten buried under more pressing work. Follow up your letter after a reasonable interval, perhaps with a phone call or another method of contact. Don't give up.

A Plan to Manage White Tail Deer

The problem with white tail deer has been the subject of discussion in many communities throughout New Jersey. This midterm letter offers a thorough review of the strategies that have been used to reduce and control deer herds. Based on the successes shown in other models, the plan section nicely balances concerns for both humans and deer in one community.

908 Genner Road
Bridgewater, NJ 08807

October 12, 2000

Bob McDowell, Director
New Jersey Division of Fish and Wildlife
P.O. Box 400
Trenton, New Jersey 08625-0400

Re: Measures for Deer Population Management in Bridgewater Township

Dear Mr. McDowell:

At this point in time your organization's mission "to protect and manage the state's fish and wildlife resources to maximize their long-term economic, recreational, and biological values for the citizens of New Jersey" is being challenged with the excessive white-tailed deer population that exists in Bridgewater Township. The solution to the deer population problem lies in adherence to your agency's goal to "maintain species diversity and optimum density of the state's fish and wildlife populations." My research indicates that the use of contraception in female deer can aid in the reduction of the population to their optimum density.

The Problem...

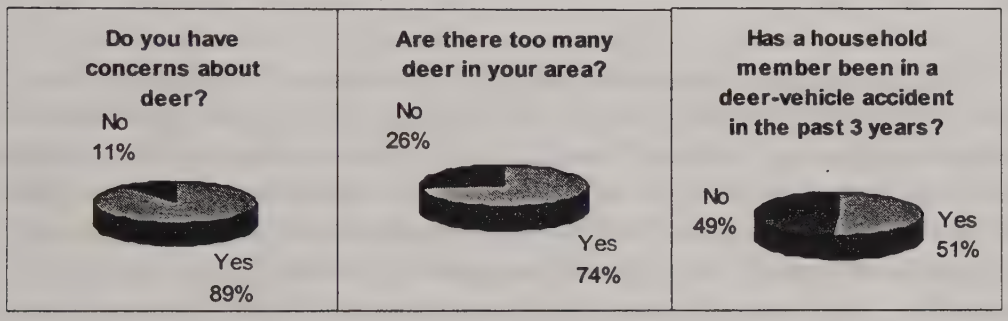
The estimated carrying capacity of an oak forest habitat is in the range of 10 deer/km^2 (Sams, Lochmiller, Qualls, & Leslie, 1998). The conditions that exist in the majority of Bridgewater Township can be loosely translated as an oak forest habitat. According to the latest published numbers, the deer population in the township is estimated as at least 1,600 deer in the township's 33 square miles (Needham, 1999A). This population density corresponds to at least 19 deer/km^2 which is almost double the carrying capacity of the habitat. In arriving at the calculated density figure the assumption was made that the deer population is evenly spread over the entire township. Unfortunately, this assumption is not realistic. In reality certain portions of the township may be experiencing deer population densities that are in excess of three times the carrying capacity of the habitat.

The Human Factor...

The excessive deer population has taken its toll on the citizens of the township. The increase in deer population has brought a rise in the cases of Lyme disease, which is an inadvertent infection of humans with an animal pathogen (Barbour, 1993). The carrier of this disease is the Ixodes scapularis tick for which the deer serve as host. Over the past ten years New Jersey has risen to 4th in the nation in number of reported cases of Lyme disease (Kaplan, 2000). Residents of the township fear for their safety from this potentially debilitating disease. One resident was quoted in the local paper as saying "I have children all around me that can't play in the backyard. If I get sick or hurt by one of these deer, I'm coming after the township." (Morella, 2000).

In a study conducted last year at the Flemington Fair, the following attitudes toward deer and deer populations were reported (Needham, 1999B):

Figures 1-3: Deer Attitudes in NJ


Do you have concerns about deer?
No 11%
Yes 89%
Are there too many deer in your area?
No 26%
Yes 74%
Has a household member been in a deer-vehicle accident in the past 3 years?
No 49%
Yes 51%

Although these figures are not specific to Bridgewater Township, they are representative of attitudes in New Jersey. The problem of deer overpopulation is not unique to Bridgewater Township. It is a problem that persists in much of the state and is impacting the quality of life for residents.

The Deer Factor...

In addition to the impact the overpopulation has on human residents, it also has negative effects on the deer residents of the township. Over the past twenty years the portion of the township inhabited by humans has drastically increased. This leaves less and less acreage for the deer to inhabit and decreases their quality of life.

In a study done by Leberg and Smith (1993), the effects of deer population density on deer growth were explored. It was determined that when densities are high enough to reduce the quality or abundance of food, the growth, fecundity, and survival of deer are decreased. Leberg and Smith (1993) determined that most especially for males, as population density increased the length of growth period increased and the asymptotic

mass decreased. Sams et al. (1998) conducted a similar study into the effects of population density on deer herds. Their findings were in agreement with Leberg and Smith (1993). This study concluded that high-density populations suffered from nutrient deficiencies, increased parasitism, and presumably social stress. These factors have a negative impact on growth as well as the survival of the herd. The incidence of tick infections with the Lyme disease tick was increased in the high-density herd studied by Sams et al. (1998) and led to a higher mortality rate in fawns.

Understanding the Problem...

Sams et al. (1998) state that "understanding the relationship between density and environment is essential for successful management of white-tailed deer herds." An understanding of this relationship can be found through literature review. Gill, Thomas, and Stocker (1997) state that "the reliability of deer population management could be improved with good density estimates." The only unknown factor for the successful management of the herd in Bridgewater Township is an accurate estimate of density throughout the entire township. Previously reported numbers were merely rough estimates.

Gill et al. (1997) conducted a study on the use of portable thermal imaging for estimating deer population density. The findings of the study included the fact that many more deer could be determined through the use of thermal imaging at night as compared to roadside counts in daylight. It was also determined that the use of thermal imaging created little disturbance to the deer. The accuracy of the deer densities determined using thermal imaging was fairly accurate when compared to population models.

Methods of Control...

One of the first methods of deer management explored was the use of hunting. This method was quickly dismissed. The reasons for dismissal included the need for strict safety regulations as well as lawsuits raised by animal rights activists (Thompson, 2000; Tucker, 1999).

The focus has shifted to more animal-friendly methods of deer population management such as contraception. A study conducted by Seagle and Close (1996) used the GAPPS II individual-based population simulation system to model the effects of contraceptive rates and immigration on deer herds. It was determined that population management programs using contraception delivery rates below 50% may be ineffective at either curbing growth or decreasing population size even at low levels of immigration. An inoculation rate above 50% would be needed to effectively manage the deer population at an optimum level.

Types of Contraception…

Over the past ten years several types of drugs have been explored for use as deer contraception. Among the drugs explored were porcine zonae pellucidae (PZP), melengestrol acetate (MGA), and levonorgestrel (LNG). Several studies have been conducted to determine the best choice for deer contraception.

White, Warren, and Fayrer-Hosken (1994) conducted a study that focused primarily on the use of LNG rods implanted in deer. The conclusions were that LNG was not effective as a deer contraceptive at the levels tested with three of the five adult females implanted becoming pregnant the first year. The study went on to conclude that the use of LNG also carried health problems in deer such as voluntary reduced food consumption. Plotka and Seal (1989), comparing the use of LNG and MGA, also concluded that LNG was ineffective for deer contraception. This same study indicated that MGA was successful in preventing pregnancy for up to two years. However, MGA had adverse effects on does implanted mid-pregnancy. Only one of five implanted does delivered a live fawn. Considering the fact that a goal of deer contraception is to not interfere with already pregnant does, MGA does not prove to be a valid choice for contraception.

PZP thus far has proven to be the contraceptive of choice for deer. It works by inhibiting fertilization through the blockage of sperm binding sites on the ovum by anti-PZP antibodies (Turner, Kirkpatrick, & Liu, 1996). In the study conducted by Turner et al. (1996) PZP was administered in three methods.. None of the does that received the first method of three separate PZP injections produced a fawn in the first year. The same was found for does that received the second method of two separate injections. The third method was a single injection along with implantation of a minipump designed for continuous release. Of the single injection fawns 20% reproduced the first year. In the second reproductive season there was little difference between the control does and treated does in reproductive rates. This finding by Turner et al. (1996) indicates the reversibility of PZP as a contraceptive.

A similar study into the possibility of PZP as a deer contraceptive was conducted by McShea et al. (1997). The results of this study were similar with no offspring production the first year in the two dose group and 78% of the one dose group reproducing. In the second year a booster was given to the one dose group which reduced reproduction rates to 22%. Again the study determined that a one dose method of administering PZP was ineffective as contraception in deer. The two dose method proved to be effective for up to two years.

Research indicates that PZP administered in a two dose method is most effective for use as contraception in deer herds. The PZP did not pose risk to does when administered mid-pregnancy. The methods used in the studies by McShea et al. (1997) and Turner et al. (1996) showed no adverse reaction by the does. The does appeared to be in good physical condition and no differences in breeding were observed between treated and

untreated does (Turner et al., 1996). McShea et al. (1997) did observe that the treated does were more active and breeded for a longer cycle.

The Plan...

Based upon my research, I propose a two-fold plan for deer population management in Bridgewater Township. The first phase is to accurately determine the extent of the problem. The second phase is to implement a strategy to reduce the deer herd to an optimum level.

For the first phase I call upon the research reported by Gill et al. (1997). The use of portable thermal imaging proved useful in obtaining a fairly accurate estimate of deer population density. The assertion was made that this type of count was only valuable in areas where the deer have become accustomed to human interaction and thus have become quite tame.

With an accurate estimate of deer density, phase two can be implemented. This phase consists of the use of PZP as contraceptive in female deer. PZP was chosen since it has proven most reliable and exhibits no adverse reactions by does (McShea et al., 1997; Turner et al., 1996). The most challenging portion of phase two is determining the number of does to be injected and how often to inject. An inoculation rate of greater than 50% has been suggested in an effort to obtain results in a reasonable amount of time (Seagle & Close, 1996). A several-injection method consisting of two injections has proven most effective when compared with single injections or pump implantation (McShea et al., 1997; Turner et al., 1996).

According to reports in the local paper, Bridgewater Township is in the process of determining the need for an Animal Control Office (Yang, 1999). It is obvious that there is a need for animal control as shown by the excessive deer population. The establishment of an office for this purpose is a logical move. The new office can be merged with the already existent Wildlife Management Advisory Committee that was formed in November 1999 (Morella, 2000). The combined office should consist of the volunteers from the Wildlife Management Committee along with trained professionals who are familiar with deer population management procedures. The staff of the animal control office should be well able to implement the deer management plan proposed for the township.

This deer management plan has all the elements of a successful plan as outlined through research. The deer benefit from a more abundant and high quality diet due to less competition for food. The deer will experience less parasitic infections and a lower mortality rate (Sams et al., 1998). The decrease in deer population will help restore the quality of life for residents as well. A successful deer management plan has been proven to aide in the reduction of Lyme disease (Barbour & Fish, 1993).

In the End...

I hope that at this point you have a better understanding of the deer population problem in Bridgewater Township and. On November 13, 2000 I will be giving an oral presentation concerning this issue in room 324 of Hickman Hall at Rutgers University. I would like to invite you to be in attendance. If you have any questions or need directions, please contact me at the above address. Thank you for your attention to this matter.

Sincerely,

Name deleted at request of student

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Feral Cat Management in Mantoloking

Rather than presenting himself as "anti-cat," this writer wants to be considered "pro-bird." He relates his plan to the funding source's concerns in a tangible way when he connects the fate of the piping plover to Mantoloking's beach replenishment funds.

14167 Oliver Circle
Brick, NJ 07358
October 23, 2000

Richard Ramirez
Mantoloking Zoning Office
202 Downer Ave.
Mantoloking, NJ 08738

Re: Control of Feral Cats in Mantoloking

Dear Mr. Ramirez:

A recent NJ Endangered and Nongame Species Program (ENSP) document described the decline of nesting success of the endangered piping plover in New Jersey. Important management needs were addressed in this document, and Mantoloking was specifically cited as an area in need of a reduction in feral cat predation. There are a variety of methods used to control feral cat populations. Mantoloking presents unique problems in methods because of the suburban character of the borough. I have a plan that I believe addresses these problems and will control the feral cat population of the area. I am hopeful that you will come to the same conclusion.

Background Information

The Mantoloking area averaged 5.15 piping plover nesting pairs from 1987 to 1997, with a single year maximum of 8 pairs. The statewide plover population began declining in the latter half of this period and in 1998, only one pair nested in the Mantoloking area. As a result of this decline, the endangered and Nongame Species Program has proposed a number of management priorities, included in which are predator removal and population reduction. . Jenkins and Niles (2000) identify predation as responsible for 48% of plover nesting failure, with mammalian predation responsible for almost half of all predation. Red fox and feral cat predation have been identified as a significant problem. Fox are a problem in less developed areas such as Island Beach State Park, not in developed areas such as Mantoloking. ESNP's focus is on state and federal beaches, but intends to develop management agreements with municipalities. Also, municipalities are required to develop management plans for beach nesting birds if they are involved in federal beach replenishment projects under Section 7 of the Endangered Species Act (Jenkins & Niles, 2000). ENSP has determined target recovery levels to be met in order to meet federal recovery goals. The target number for nesting pairs in Mantoloking is 4-6 nesting pairs.

If progress towards the federal recovery goals fails, there will be additional federal scrutiny of these replenishment projects, as well as local beach management (Jenkins & Niles, 2000). These facts show that it is in the best interests of the borough to institute a plan for feral cat reduction.

The problem of feral cats has become significant due in part to societal attitudes regarding the abandoning of unwanted animals, and the high fecundity rate of domestic cats (Mahlow & Slater, 1996). The potential for reproduction is staggering. Olson and Johnston (1993) estimated that 2 cats, producing 8 kittens per year, could produce 174,760 cats, assuming no kitten deaths. A practical example is that of Marion Island, a sub-Antarctic territory of South Africa. 5 domestic cats were introduced as pets in 1949. This population grew to an estimated 2,139 by 1979 (Bloomer & Bester, 1992). In addition to high fecundity, cat numbers can be kept artificially high because of supplemental feeding by well-meaning members of the public (Coleman & Temple, 1993). Liberg (1984) found that despite supplemental feeding, cats continue to hunt prey.

Although most of the studies describing the adverse effects of feral cats on wildlife have been conducted on islands, other studies show that they can affect mainland wildlife as well (Patronek, 1998). The Wildlife Society (2000) extends the term "island" to mean islands of habitat. The beach of Mantoloking, surrounded by ocean and residential development, fits this use of the term "island". The Society also states that the effect of cats can be particularly devastating when prey populations are already low. This is an accurate portrayal of the population status of the piping plover and further suggests the need for cat control.

Methods of Feral Cat Control

There are various lethal and non-lethal methods used to control unwanted predators. Short et al. (1997) describe common lethal means including spotlight shooting, trapping with leg-hold traps, hunting with dogs, and poisoning using the compound sodium monofluoroacetate (1080), and goes on to declare poisoning as the most effective of these methods, particularly in rural areas. These methods present a number of problems that will be addressed later. Another lethal means of animal control is trapping and euthanasia. This is a very common and long used method and is usually used in conjunction with adoption of kittens and docile older cats (Mahlow & Slater, 1996).

The problem with lethal control is that it is highly improbable that 100% elimination will occur. High fecundity allows any cats left to repopulate the area. In addition, removal of cats creates a population vacuum that allows cats from adjacent areas to move into the area in question (Zaunbrecher & Smith, 1993, Mahlow & Slater, 1996). Arguments such as these are used as positive evidence for the use of non-lethal means of control such as contraception and sterilization. These methods may be used exclusively or in conjunction with lethal methods.

Non-lethal methods of cat control are particularly effective in areas where the primary goal is to stabilize rather than reduce the population. Zaunbrecher and Smith (1993)

found that a continuing program of neutering and releasing feral cats can stabilize and eventually reduce the population of a colony through attrition. A sterilize and release program assumes that these cats play an important ecological role by occupying an empty predator niche (Mahlow & Slater, 1996). Cats are released at the location of original trapping. Mahlow and Slater also assert that, in addition to the overpopulation problem, this approach also reduces common nuisance behavior such as roaming, spraying of urine, and fighting.

The use of contraceptive medications in feral cat control has been used little in the US. Common medications used in dogs and other animals have not been approved for use in cats. The use of such drugs would also present logistical problems in instituting a plan for use. Permanent sterilization is generally the desired method of control in feral cats. It would be a very rare scenario where contraception would be the desired method of control (Mahlow & Slater, 1996).

Non- lethal methods of control have the advantage of being more palatable to the public. Although an argument can be made for lethal control that may gain some public acceptance, there is growing public opposition to lethal control methods (Patronek, 1998). This growing attitude is compounded by society's view of cats as companion animals. There is, however, the drawback that non-lethal methods do little to immediately lower the cat population in instances where this is required.

Legislation and Education

Any population reduction program will have short-lived effectiveness without a change in public attitudes toward feral cats. An examination of the Borough of Mantoloking web site shows that there is deep concern on the part of both the local public and government regarding the control of dogs. Ordinances shown on the web site pertain to; "dogs and other animals" but do not specifically address cats. Mantoloking is not unique in this instance, as animal control laws have historically focused on dogs (Mahlow & Slater, 1996). Although dogs also pose a threat to piping plover nesting success, such animal control ordinances should specifically mention cats. Specific legislative remedies suggested by Mahlow and Slater (1996) include, differential license fees for sterilized and non-sterilized animals, expansion of the term "owner" to include guardians and caretakers of feral cats, mandatory leash laws for cats, and mandatory sterilization of all owned and stray or feral cats.

Public education is a very important aspect of changing public attitudes regarding feral cats and one that often listed low on the list of priorities. This is due to the fact that results can be slow and difficult to measure qualitatively (Mahlow & Slater, 1996). Mahlow and Slater (1996) as well as Patronek (1998) stress the need for public education regarding the responsibilities of pet ownership and the hazards free-roaming cats present to wildlife.

A Plan for Mantoloking

Mantoloking presents some unique problems to instituting a feral cat control strategy. Because of the borough's suburban makeup and status as a resort, lethal methods such as shooting and leg-hold traps are obviously undesirable. Poisoning is also not an option, as it is likely that non-targeted animals, such as pets and scavenging gulls, may also ingest the poison bait (Short, et al., 1997), and a problem of carcass clean-up would also have to be addressed. Also, as mentioned before, there will be strong public opposition to lethal control methods. Unfortunately, non-lethal methods alone will not solve the problem due to the immediate action that needs to be taken to reverse the negative trend in piping plover nesting success. Jenkins and Niles (2000) state that if this trend continues, the piping plover will become extirpated from New Jersey in the current human generation. This problem cannot be remedied without an immediate reduction in predation.

It is because of this requirement that I propose the following multi-faceted plan. Lethal means are necessary to immediately lower the cat population. Trapping and euthanasia presents the best plan for Mantoloking. Trapping allows examination and evaluation of animals by a participating veterinarian for adoption suitability. Those healthy cats that are young enough or docile enough would be eligible for adoption, with others being euthanized. This method would also allow holding of animals for recovery in the event of capturing any pets that are allowed to roam free, and may also be more acceptable to the public. This first stage of the plan will be utilized to lower the cat population to a manageable level.

Once the cat population has been lowered significantly, the non-lethal second stage of the plan, designed to prevent the regrowth of the population, will begin. This stage calls for trapping and sterilization, followed by release. Zaunbrecher and Smith (1993) found that sterilization programs, even with new cats emigrating due to the vacuum effect, could effectively stabilize and even reduce cat populations. This second stage will be ongoing, thus preventing further use of euthanasia, which is meeting with increasing public resistance. This stage should find more acceptance and cooperation from veterinary medical professionals and animal welfare groups, and could benefit from such cooperation. Zaunbrecher and Smith (1993) found that working in a cooperative effort with veterinary professionals can keep the costs of such a project surprisingly low.

In addition to these direct actions, public education and legislation should be implemented in concert with population reduction methods in order to stem the tide of acts and attitudes that allowed the problem to grow in the first place. All ordinances established for the control of dogs should also be extended to cats. Ordinances of this type provide a built-in mechanism for monitoring the cat population of an area. Ordinances that should be extended to cats include licensing, leash laws and any other regulations concerning free-roaming animals. Other ordinances should also be considered, including limiting cats to enclosures when out of doors.

Public education can be a difficult thing to develop and put into action. Fortunately, the American Bird Conservancy's "Cats Indoors" educational program already exists.

Endorsed by ENSP, this program strives to inform cat owners and public officials of the devastating impact that free-roaming cats can have on wildlife. The program offers suggestions on how to alleviate this damage as well as advice on keeping a cat healthy and happy indoors. Such a program can be a great assistance in changing public attitudes and can be made more effective with the cooperation of local conservation and animal welfare groups (Jenkins & Niles, 2000).

I hope that you will find that a reduction in feral cat numbers in Mantoloking is a beneficial undertaking and that the above plan is feasible. It is my strong belief that the plan that I have described will be effective in achieving an immediate and long lasting reduction in the feral cat population of Mantoloking, that would aid in raising the rate of nesting success of piping plovers in the area. If you would like to give me your input into the proposal, or have any questions, please contact me at xxx-xxx-xxxx. I look forward to hearing from you.

Sincerely,

Joseph X. Xavier

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Xxxxxxxxxxxxx
xxxxxxxxxxxxx
February 26, 2001

Ara K. Hovnanian, President/CEO
Hovnanian Enterprises Inc
10 Highway Street
PO Box 500
Red Bank, NJ 07701

Re: BIRD NESTING BOX CONSTRUCTION AND PLACEMENT PROGRAM IN NEWLY DEVELOPED AREAS

Dear Mr. Hovnanian:

I would like to take a moment of your time to introduce an idea I have concerning housing development in areas that are home to many different species of birds. As a well-known developer, you know the processes of clearing forests and land for the development of new housing sites. Human expansion is the primary reason for reduction and loss of wildlife due to habitat destruction (NJ Division of Fish and Wildlife, 2001). It has been this way for hundreds of years and there does not seem to be an end in sight. The only way to help save these many different forms of wildlife from endangerment or extinction is if humans take action to help conserve and restore these creatures. My plan is to build nesting box stations in various areas near or in the remains of destroyed forests in order to allow the birds access to temporary or permanent shelter and breeding sites. This action will help birds adapt to their disturbed habitats and procreate normally and successfully. I know that Hovnanian Enterprises is devoted to beautiful developments that are most conducive to buyers and would be glad to learn of such ideas that can help conserve wildlife as well as attract people to the area. Due to the current climate of rethinking development strategies in many townships, you might also find the advertising and public relations benefits of this plan helpful for your company.

The project that I will introduce to you is not only helpful to the birds in the areas you will be developing but will also be advantageous to the buyers of your area. Many of the developments you create, such as the new Liberty Green Housing Area, are for first time buyers which include families with children. Most families are looking for a site fulfilling both their needs and their children's. They feel their children should have the benefits of growing up in areas surrounded by nature and wildlife, but still be in an urban setting and have access what is around them. Presenting this nesting box idea to most buyers would be very beneficial in that they would feel they would be living in an area that is biologically friendly along with possessing the advantages of living in an urban/suburban area.

Why Are Birds Scarce in Developed Areas?

As cities and towns grow, consuming the surrounding countryside, a great deal of nesting habitat is lost. Things such a dead or hollow trees, scrubby woodlots, and brushy road and field edges which are removed when development takes place, may look messy and unkempt, but such places are ideal habitats for nesting birds. Bird nesting behavior can be classified according to how they make their nest sites. Cavity nesters are birds that use hollow, enclosed area, such as hollow trees, for nesting. Birds such as woodpeckers are considered excavators meaning that they create their own cavities in dead or dying trees (Jackson, 1988). It is important for courtship purposes that woodpeckers create new cavities each spring, which leaves their old nest holes for non-excavating birds such as the eastern bluebird and tufted titmouse to nest in. These holes, located in trees that may seem unappealing to onlookers, are the main breeding sites of cavity nesting birds. When houses are built in places such as these, living or non-living trees are removed, and birds lose a great deal of their breeding sites.

A recent study conducted by the New Jersey Division of Fish and Wildlife showed the breeding trends of over forty species of wild birds in New Jersey. The breeding status of over 90% of the birds studied was shown to be a special concern. The study defines a species of special concern as one that needs special attention because of their vulnerability to environmental deterioration or habitat modification that would result in their becoming threatened. This confirms the need for human intervention through breeding encouragement in order to save these birds. Certain measures are currently being taken to help these species from becoming threatened. Habitat destruction is a major reason for the decline of breeding birds and the presence of other bird species. Many programs have been created with the objective of minimizing the problems caused by reduced wildlife habitat area by constructing sites in which birds can breed and nest normally.

How Have Programs Like This Worked in the Past?

Bird population studies have shown that nest box programs, such as the one I propose, have aided in the survival of species such as the eastern bluebird. In the late 1960's, the bluebird population was rapidly diminishing mainly due to urban growth. Even though this urban growth has continued, some of the bluebird population has recovered due to the success of different nest box programs. The population of the eastern bluebird has increased by almost 50% since their decline was detected in the late 60's (Davis and Roca, 1995). The NJ Division of Fish, Game, and Wildlife has specific reports on programs including the bluebird project. The data contained in these reports show significant successes of seven forest songbirds due to the creation and placement of artificial nest boxes. The 1998 report documented the occupancy of almost 80% of the boxes erected. Of the 783 total boxes, 610 were occupied and contained a total of almost 4000 eggs. Almost 90% of the eggs laid were hatched and those birds successfully fledged (flew from the nest). The high occupancy percentage shows how much these birds need and appreciate the boxes. The sites that they would use otherwise were either

unfavorable or scarce. Unfortunately, forests and other habitats are becoming increasingly scarce in New Jersey and in many other areas across the nation. There is a growing need for our involvement to help birds and other forms of wildlife coexist with us humans.

Programs such as the bluebird project I described are run by environmentalists or state and federal districts proposed by environmentalists. However, there have been many successful programs run by developers like yourself. For example, golf courses over the United States have come to offer excellent opportunities to provide important wildlife habitat in urban areas. With more than 15,000 golf courses in the U.S. comprising over 1.5 million acres, great potential exists for these areas to become an important part of the conservation landscape (USGA, 2001). These programs consist of design and management for wildlife habitat conservation, management techniques for specific bird species, as well as construction of artificial nest structures. Both these golf courses and development for resident and commercial areas need to take part in the survival of bird species. Residential environment such as the ones you create, are prime sites for this kind of conservation to take place. This way, the birds can reside in a familiar and comfortable environment where they can be enjoyed by the many resident in the area.

There have also been major programs created to help in the survival of birds such as the osprey, peregrine falcon, and bald eagle. These programs include construction and intense monitoring of nesting structures in order to encourage normal breeding behavior and alleviate the pressures from habitat degradation. In 1973, the osprey was labeled endangered with a total of only fifty nesting sites in all of New Jersey. The peregrine falcon had disappeared entirely from the East Coast in 1965 and the bald eagle was headed for extinction with only a single nesting pair in 1973 (Wolgast, 2001). That is when a few concerned individuals along with generous funding sources evoked a major nesting structure project which has significantly increased the amount of nest sites and, in turn, the number of nesting pairs. These numbers have increased to over five hundred osprey nests and twenty-two bald eagle nesting pairs, which is the maximum amount ever documented. This demonstrates the necessity for human involvement in saving these birds by programs such as this.

The Plan of Action

Nest boxes are a primary aid for survival and procreation in many animals, including birds. They use these boxes to lay their eggs and incubate as well as for shelter in the cold winter months. Various styles of boxes are suitable for each particular species of birds. The differences among the boxes include dimensions, entrance hole size, material, and location they should be placed in desired area (Schneck, 1992). It is necessary to create a box for a particular species in order to encourage occupancy of the desired bird.

Boxes will be constructed according to proper attributes and then placed in the remaining forest or tree area in which development has or will take place. Birds, like humans, have their specific location and housing preferences. If a nest box is placed in a location which is good for a bluebird, but the entrance hole is too small or the dimensions are wrong, the

bluebird can not use it. It is important to know what the bird's preferences are. It has been studied that different species of birds, such as the pied flycatcher, are more likely to occupy a nest box when placed fifty to one hundred meters away from housing areas rather then right at the edge (Huhta, Jokimaki, Pekka, 1999). These boxes will be erected up on poles or on the side of trees at a height suitable for the species of bird and the environment.

I will provide a survey for each homeowner in the prospected area in order to please each and every individual in their new homes. Along with the survey, I will provide an information packet including: why it is important we construct these boxes, ways to identify birds in the area, information on setting up feeders and water areas around the house, and other information on how everyone can help to conserve the wild and the creatures within it. With this survey, I can please the individuals already concerned about wildlife along with informing people who may be unaware of what exists around them.

Conclusion

I hope I have shown you how important it is to maintain the diversity of birds throughout the area. The benefits you will achieve if you partake in my project will continue for years and the happiness of the potential buyers of your area will be endless. Nature is a luxury that many humans are unable to enjoy due to poor conservation efforts. You would be giving people the benefit of a beautiful home along with a variety of birds to coexist with and at the same time, help many species of birds survive and procreate. I take this time to invite you to my oral presentation in which I will explore my project in great detail. I will present the different types of boxes needed for each particular species along with the budget for my project and the plan of action. If you would like to have a copy of my full proposal or if you would like to speak with me, I can be reached at xxx-xxx-xxxx. Thank you for your time and consideration and I look forward to hearing from you in the future.

Sincerely,

Julie X. XXXXX

References

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Chapter Seven

The Oral Presentation

The Assignment

The Oral Presentation is a 10 to 15 minute spoken proposal addressed to the imagined audience (i.e.: the people who might fund your idea). This is a formal presentation and you must use visual aids to help convey information clearly and effectively. The point of the presentation is to make a leadership statement for a specific audience that puts information into action by proposing a research-justified solution to a well-defined problem.

The oral presentation is both a useful step in the process of developing your project and a unique assignment for which you will receive a grade. It therefore serves two sometimes competing purposes:

- As an "oral draft" of the final project, it's an opportunity to rehearse your audience-awareness, to organize your research, to develop your plan, and to get feedback from the class and the teacher on how to improve your project. At least half of your grade will be based on how well you have researched your project and how well prepared you are to put together the final proposal.

- As an exercise in public speaking, it's a chance to practice the arts of oral persuasion. Part of your grade will be based on how well you perform as a speaker.

While instructors will generally focus their grade and their remarks on the strength of your content, offering advice on revision, they will also take notice of your form and poise. Usually, those students who are best prepared with their content do best overall.

The basic parts of the presentation are laid out below. I suggest that you read over the advice offered here, especially if this is the first time you have ever spoken before a group.

The Basic Parts of the Presentation

Every presentation will have to take its own form, based on the situation and the topic. If you are addressing a potentially resistant audience, for example, you may have to begin by winning them over or addressing possible objections they might have to your idea. Therefore, students should recognize that they cannot always adhere to a single form for the talk, and the outline below may have to be adapted to your particular needs.

As part of the drafting process of your proposal, the oral presentation gives you a chance to firm up your project and work out all of the parts. You should therefore keep in mind the "Five P's" of the project proposal: people, problem, paradigm, plan, and price. Your talk should suggest the basic form of the final paper, and should do these nine basic things:

1. Announce your topic with a "title slide," which should display your name and the title of your talk. This corresponds to your title page.

2. Begin by addressing your specific audience, explaining why they should be interested in your project. This corresponds to the letter of transmittal in the final paper, where you address the "People."

3. Give your audience some sense of how you'll proceed, perhaps with an outline. This corresponds to the table of contents in the final paper.

4. Define the problem and try to quantify it in some way. This corresponds to your introduction section of the final paper, where you will generally lay out the "Problem."

5. Present your research, being sure to cite sources. This will correspond to the research or literature review section of the final paper, which is where you develop your "Paradigm."

6. Describe your plan of action. This corresponds to your plan or procedures section, where you set forth the "Plan."

7. Tell us about your budget and explain the "Price."

8. Close with a call to action, which might correspond to your discussion section of the final paper.

9. Along the way, be sure to use visual graphic aids, just as you will in your final paper

The two main differences, then, between the oral presentation and the final paper is (1) that the oral is spoken and (2) that it is missing a bibliography of sources.

How to Prepare

As with all assignments, you'll have to prepare in the ways that have worked for you in the past. But here is some advice if you don't know where to start:

- **Research your imagined audience.** Who do you imagine might come to your talk? What is their degree of prestige and power? What level of knowledge or technical sophistication do they possess? What are their names? Many people like to begin

their talk by welcoming the people in the imagined audience and thanking some of them by name for coming. The more specifically you can imagine your audience the better your talk will be.

- **Plan ahead.** You can't wait to the last minute to prepare for a talk, and the sooner you start the better. The most important things to work on ahead of time are your visual aids, especially any visual graphic aids you want to use, such as video, slides, or laptop computer images. The sooner you begin putting your overheads and visuals in order, the more secure you will feel about the presentation itself.

- **Focus your talk around key points or examples.** Remember that you can't cover everything in your talk, but you will be able to cover the major points of your argument and the chief examples that support you (which you should be able to discuss in detail). If you can establish these points on paper, you will be able to focus your work.

- **Prepare an outline.** You will definitely want to prepare an outline for yourself, and you likely will want to provide your audience with an outline as well so they can follow you more easily. As you outline, pay attention to the logic and flow of your talk.

- **Develop solid visual graphic aids.** Remember one rule of thumb: if it can be represented visually, then it should be. You should have at least three visual graphic aids (visual representations of numerical information), but if your talk will cover technical information or you will be referencing numerical information you may need to use more than that. These should be effective and useful to your talk.

- **You might prepare notecards for details.** You shouldn't read your talk, but you may need to write some things down for reference. You may want to use notecards to remember numbers, names, and key details you want to cover. Number your notecards so you can keep them in order, and try to key them to your outline for easy use.

- **Know your information and examples so you can talk about them freely.** One of the best ways to prepare for the talk is just to read over your research so that you know your topic well. If you can talk about your key examples off the cuff, then you will do fine.

- **Rehearse the talk out loud.** The key to preparing any fine performance is a dress rehearsal. Practice in front of the mirror or, better, in front of a friend. Time your talk to make sure it will not run over 15 minutes (you'll be surprised how easy that is to do), and so you have a better sense of time management. If you are especially nervous about speaking in a classroom, rehearse your talk in an actual classroom.

- **Get some sleep the night before.** A good night's sleep may be the best preparation for any situation where you will be the center of attention.

- **Double check everything.** Make a checklist for yourself. Are your overheads in order? Do you have your notecards? Make sure you have everything covered. Arrive early to test and set up any equipment you plan to use.

The Question of Delivery

Delivery is all about ethos. Do we believe you? Do you impress us? Do you know what you are talking about? Like the way you package and present your final paper, the way you present your information will go a long way toward keeping their interest and attention. Here is some general advice on delivery:

- **Dress the part.** Students always ask, "Do we have to dress up for our presentation?" I usually respond, "It depends on your imagined audience." You should definitely wear clothes that are appropriate to the context. If you want to make a good impression, it's generally a good idea to break out some of your better clothes. Sweat pants will not reflect well on you in any situation. For men, a tie is always best, but an outfit you would wear on a casual Friday at an office job might do. For women, any outfit you would wear to an office job should be sufficient. Ask your instructor for specific guidelines.

- **Create the context.** Clothes are only part of setting the stage for your talk. You'll also want to indicate your imagined audience and acknowledge their interests whenever possible. Highlight the fact that you know your imagined audience well and make sure that you keep them in mind throughout.

- **Use a tone appropriate to your imagined audience.** One way of keeping the audience in mind is by using the same language and tone that you'd use if they really were in the room. If you are asking University officials for money, for example, you wouldn't want to talk about "the RU Screw."

- **Enunciate and speak clearly.** This doesn't always mean speaking loudly, but you should speak clearly enough so that everyone can hear you.

- **Make eye contact.** Try to make eye contact with everyone in the room at some point during your talk.

- **Don't rely too much on notes.** Organize your presentation around an outline and use notecards, but *do not write out or read the presentation*. In other words: speak it, don't read it. You should know your information well enough at this point to be able to speak with confidence and knowledge using only an outline and visual aids to support and guide you. If you need to write down facts, figures, names, or an outline, use notecards because they are relatively unobtrusive. Try not to put too much between yourself and the audience.

- **Project energy and "sell" your idea.** If I have one major criticism of student presentations, it's that they rarely give off much energy. Imagine that you are really asking someone for money. You have to sell them on your plan. Turn any nervousness you have about the talk into energy and put a little bit of performance into your presentation. It will count for a lot with your audience and will keep them interested.

- **Ignore distractions and mistakes.** Everyone slips up here and there. Don't draw attention to mistakes, but move on so that both you and your audience can leave them behind.

- **Move for emphasis only – don't pace.** Everyone has ticks and idiosyncratic actions that come out when they speak before a group. One person I know always holds a cup of water between himself and the audience as a sort of shield. Odd ticks are usually an unconscious way of defending yourself from the people you're addressing. Pacing, for example, presents your viewers with a moving target so they can't hit you if they start to throw vegetables or bricks. Try to recognize these actions ahead of time and work through them. You have nothing to fear from your listeners, so try generally to stand still. Just don't stand in front of the screen too often or you'll be blocking people's view of your visual aids.

- **Be careful with humor.** Many guides to giving oral presentations will tell you to begin with a joke to loosen up your audience. What if you're talking about an especially serious topic? Use humor in moderation and only where appropriate.

Advice on Overheads

Overhead transparencies are extremely useful and versatile, and they will likely not go out of style for a long time because they are relatively inexpensive, easy to prepare and transport, and widely available. Since most students rely almost exclusively on overhead transparencies for their visual aids, here is some advice on preparing and using them:

- **Begin with a title transparency**. Be sure to have a title transparency that sets the stage for your talk and introduce yourself and your topic. It also helps to make a good first impression -- especially if it is well prepared. The title slide, like a title page, should display your title, your name, and your organization. Use white space, graphics, color, or design elements that are consistent with your other slides to make it attractive.

- **Use a transparency for each section of your talk.** Each section of your talk -- or even every topic you cover -- should have its own overhead. This way you can mark the turns in your argument by changing the visual image, and you can help guide your audience through each part.

- **Have one theme per transparency.** Remember not to crowd too much information onto each transparency. It's best to just try to cover one theme on each one.

- **Give each one a header (and number them if it helps you).** Each of your overheads should have its own head line or header, indicating the topic it covers. You might want these headers to correspond to the outline you presented earlier to make your talk easier to follow. Headers should have a consistent style and form and should give a good idea of what you'll cover in that section of your talk. You might also want to number your overheads -- perhaps keyed to your outline -- so that your audience can follow more easily and so you will be able to quickly put your overheads back in order if they become mixed up.

- **Be sure to cite sources on graphs.** Each visual graphic aid that uses information derived from a source should have a "source" reference at the bottom, fully visible to your audience.

- **Use large letters and a clear font.** Remember that your overheads have to be seen in the back of the room as well as the front. Make them as clear and as large as possible, yet strive for an attractive appearance.

- **Maintain a consistent font and style**. All of your overheads should have the same font and if you use a border it should be the same on each one. Often it is less important to follow any rule than it is to be consistent in the styles you choose. Such consistency helps to project a sense of unity to your presentation.

- **Try a unifying border or logo**. To help further project that image of unity, you can use a logo or border on each overhead. This is especially useful when you are representing a company, where you may want to have your company logo or a border with colors or a style consistent with your company image.

- **Jazz it up with color if you can**. There is no question that people are impressed by color, and your presentation will stand out more if you use color in your slides and in your visual aids. However, if expense is an issue you may want to stick to black and white.

- **Strive for active voice**. Use active voice forms in your overheads whenever possible, just as in all business writing.

- **Put numbers in a visual graphic form**. Remember that if something can be illustrated it probably should be illustrated. A picture is not always worth a thousand words, but it will usually keep you from using a thousand words to say the same thing. If a number or an idea or a definition or a procedure can be illustrated it probably should be. Also, if you can use an overhead to help reinforce your audience's understanding, then be sure to have an overhead.

- **Let the audience absorb each overhead.** Too often students don't leave their overheads up long enough, often because they are hurrying through the presentation. Try to manage your time well and use an overhead for each section of your talk, leaving each one on the projector until you raise a new topic.

- **Point to your overheads for reference.** Draw your audience's attention to key aspects of your overheads by pointing to them. You can do this in several ways -- on screen, on overhead, with a shadow, or with a transparency pen.

Some Overhead Don'ts

- **Don't use all caps.** Studies show that people can distinguish words and parts of sentences more easily if you use both lower case and capital letters. Readers also perceive text written in all capital letters as shouting. And you should not shout at your audience.

- **Don't put too much information on each transparency, or use long sentences, because viewers cannot absorb it all.** Try to put no more than short phrases on each overhead, and don't overcrowd them. If you find yourself putting a lot of information on an overhead, then likely you need to break that information up to fit on several sheets.

- **Don't use letters smaller than 20 point.** Remember that the people in the back of the room will have trouble with small letters.

- **Don't violate the rule of parallel form**. Each overhead should have information that fits together in such a way that you can list it using phrases in parallel form. This helps the audience to see connections and to organize information.

- **Don't be inconsistent in capitalizing words**. In fact, don't be inconsistent about anything. If you make a choice

- **Don't forget to proofread for typos**. Typos on an overhead are like an unzipped fly: they destroy your ethos and make you look silly.

Final Words of Advice

Recognize that it's normal to be nervous.
Most people feel a bit nervous whenever they have to speak before an audience, especially the first few times they have to do so. Remember that this is normal. If fears persist, though, here are a few thoughts that might help you get past your fears:

- Remember that you know more about your topic than anyone in the room. Just try to make yourself clear and you will automatically have something to offer the audience.

- Your listeners take your nervousness for granted. In fact, since most student listeners are not used to giving presentations themselves, they expect everyone to be nervous and will either overlook or identify with your situation.

- This might be the most friendly audience you'll ever face. As fellow students, your listeners are on your side and generally want to give you high marks: I often notice that student reviewers generally see the most positive aspects of individual talks and tend to overlook problems (even after I have urged them to offer critical comments).

- Recognize that if this is your first talk it is a necessary right of passage. The more practice you have giving presentations, the easier they will get and the less nervous you will feel each time.

- Turn fear into motivation. Nervousness can be a spur to greater preparation. Fear is not necessarily a negative thing, but the way you respond to it has to be positive. One common negative response to fear is procrastination, which is merely avoidance behavior (a variation on running away). The best response to fear is work, which can only help you in developing your project and bolstering your confidence in your subject knowledge.

If you still have worries or fears, talk them over with your professor or with friends. The more you face your fears, the better off you'll be in the long run.

Don't talk down to your audience, but challenge them to follow.
The biggest mistake that students make in presenting a technical subject is trying to get their audiences "up to speed" by giving lots of background information, usually in the form of textbook knowledge, before they begin the presentation itself. Background information should not be presented at the start, for several reasons:

- It destroys the fiction you are trying to create that you are speaking to a knowledgeable audience. Right away, you have confused your listeners as to who your audience really is.

- It sets the wrong tone, making your audience feel like they are being talked down to by a school master. Treat your audience as equals and they will prick up their ears in order to become equal to your conception of them.

- It underestimates your audience's intelligence. Because you are speaking to a college educated audience, most of your listeners will already possess much of the basic knowledge needed to follow your talk. There may even be some audience members as expert as yourself in your field of study. Listeners will feel insulted by your explanations of "osmosis," for example, and will tune you out. Challenge them to tune in instead.

- It wastes time that you will need to present your idea. Remember that you only have about 12 minutes (and a maximum of 15) to give your talk. How can you present everything you learned in your core curriculum in such a short time? You can't, so don't try.

- It mistakenly tries to anticipate questions which are best left to the question and answer period. Remember, if someone in the audience doesn't understand something they can always ask about it afterward. And what question is easier for you to handle that the most basic questions where you get to show off the breadth of your knowledge?

- It will not make sense in the abstract. Because information is never useful except in context, audiences have a very difficult time understanding definitions, explanations, or lessons offered in report form apart from the flow of argument.

- It is unnecessary. If a presentation is organized logically, your audience will follow your argument even if they do not understand all of the details. If you feel it is necessary to explain certain technical ideas, remember that it is much more useful to offer such explanations briefly in the context of your argument (or in the question period after) than it is to give them ahead of time. Just do your thing with confidence and your audience will be impressed, especially if they don't understand all the details.

Logic should govern above all. This final point was brought home to me once listening to a student presentation on training co-op students to use proper care and technique in recording information in the field so as to comply with government regulations. Basically, these students were making many small mistakes (such as recording temperatures in Fahrenheit instead of Centigrade) that were destroying the integrity of whole projects. What could be more understandable? Yet the speaker began by presenting "background information" about the type of studies the students were doing and the specific data they were collecting. By the time she had finished offering that long explanation she had to rush through her plan to train these students in better data collecting techniques. As one reviewer in the audience noted, "I had no idea what she was talking about until she said that these students were using felt-tipped pens on rainy days to write down information." Basically, the audience did not need to know what was being written down with that felt-tip pen to understand that such pens posed a problem in the field.

State your argument up front; don't keep your audience in the dark.
You'll never have your audience's attention more than you do at the outset of your talk. So tell them as much as you can up front. Someone once said that the best advice for giving a talk is to do three things: "One: tell your audience what you're going to say; two: say it; and three: tell them what you said." While following that advice literally will lead you to an overly formulaic presentation, it does suggest the importance of leading your audience clearly through your argument with all of the forecasting statements and signposts you can muster. As I suggest above, one of the easiest ways of helping your audience to follow your talk is to provide an outline at the outset and then use overheads

to signal your transitions (just as you should use strong topic sentences to signal your transitions at the opening of a new paragraph in writing).

Focus on your evidence.
The most important aspect of the presentation is that you show that you have the evidence and research to support your assertions. Just as you would do in a written form, be sure to cite your sources. Name the authorities who inform your paradigm. Name the sources for all statistical data you cite. Name the authors of studies or experiments that you reference. Describe examples or models you reference in specific detail. Emphasize that there is a wide array of evidence to support you in your claims.

Illustrate your budget with a pie chart.
As part of your plan, you must include a budget, since it is one of your imagined audience's biggest concerns. Since this is one place you will always have numbers to work with, why not use a nice pie chart or other visual aid to sum up your budget? A pie chart is most appropriate because it lets you enumerate both the total and the parts.

Close with a polished call to action.
The closing of your presentation should sum up the plan you have in mind and urge your audience to act upon it. Hence the content of your close should focus on what needs to be done, and it should take a form that tries to influence your audience to act. Use whatever rhetorical powers you can muster to get them to listen. Listeners tend to remember best what comes at the beginning and at the end of a presentation more than anything in between. Therefore, in the same way you should strive to make a good first impression, you should close your talk with words that reflect well upon you as a speaker and offer up the "take home" message of your talk in a memorable way. Some speakers actually write out their closing words in order to polish and hone their form and tone. A strong close also signals clearly the end of your talk and lets the audience know it is time to applaud.

Welcome…

Nassau County Water Authority

Director Bill Owens and staff

Water Conservation and Management Awareness Program Nassau County, Long Island, NY

Jennifer Small

November 9, 2000

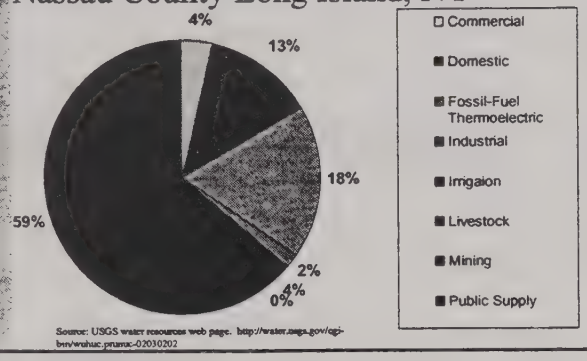
Agenda

- Water management and conservation – a brief introduction.
- Why is water conservation and management necessary for Nassau County?
- Suffolk County's water authority's conservation and management programs –why do they work?
- What actions can be taken to combat this problem?
- How much will this plan cost?
- Questions and Comments

Water Management and Conservation

- Environmental effects
  - Protection of natural resources
- Economic Effects
  - Costs are reduced or eliminated regarding contamination clean-up.
  - Regulatory compliance costs are reduced.
  - Improvement in material consumption efficiency (i.e. cleaner water)
  - Reduction of financial liabilities by decreasing the potential for cleanup and their-party compensation.

1990 Water Use
Nassau County Long Island, NY

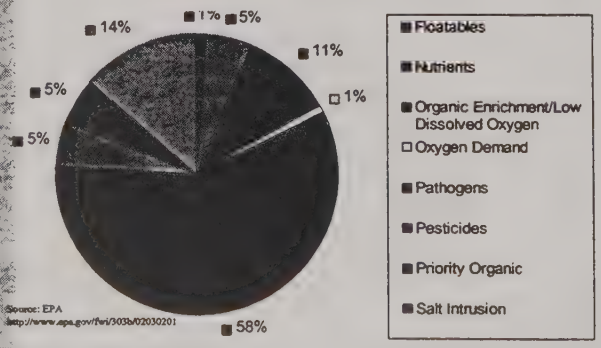


Source: USGS water resources web page. http://water.usgs.gov/cgi-bin/wuhuc.pruma-02030202

Nassau County's Water Contamination Problem

- Increased population in Nassau County.
- Development of Pine Barrens for housing purposes.
- Increased strain on watershed due to increased water demand.
- Addition of anthropogenic pollutants.

Parameters of Concern for Nassau County Long Island, NY



Source: EPA http://www.epa.gov/fwi/303b/02030201

Suffolk County Water Authority Programs – A Model

- Pollution Prevention Program
  - Aimed at businesses and industry.
- Groundwater Guardian Program
  - Similar to "Adopt-a-Highway" programs.
- Read H_2O Program
  - Aimed at homeowners.
  - Reading your own water meter and calling it in to the SCWA.
  - Participation eliminates estimated readings and keeps meter reading costs reasonable.

Benefits of the SCWA's programs

- Pollution Prevention Program
  - Increased waste reduction
- Groundwater Guardian Program
  - Involves the entire community
  - Increases familiarity with the water cycle on Long Island
- Read H_20 Program
  - Saves customers a dollar each quarter and eliminates estimated meter readings.
  - Water rates are among the lowest in New York State.

Improvements on SCWA's Plans

- Information presented in an easy to understand manner.
- Demonstrations on site during the seminars of products and hardware instillation and uses.
- Seminars aimed at local community rather than solely at business and industry.
  - Domestic use is a far greater percentage of the total water use than commercial use.

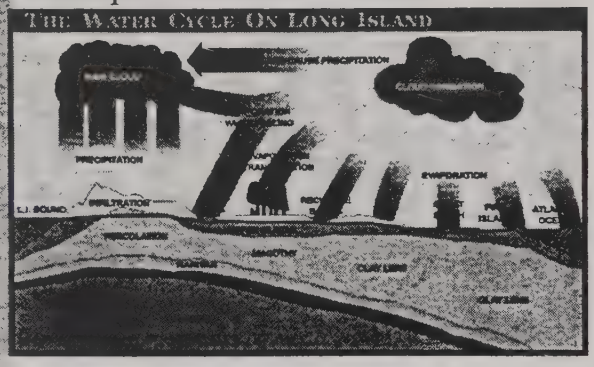
Plan Of Action – Basics

- Advertisement for seminars
- Educational seminars in ten locations.
- Total of six seminars spanning many topics geared to educate the public about water conservation in their community.
  - Distribution of informational materials and publications
  - Demonstrations regarding installation and functionality of hardware and water conservation products

Plan of Action – Seminar Topics

- History of water use in Nassau County.
- Current water use of Nassau County.
- The Magothy-Lloyd Aquifer system: Why do we use it?
- Types of water contamination in Nassau County.
- Water and well testing techniques.
- Water conservation methods an introduction.
- Water conservation methods and demonstrations.
- "Green" building practices and practical uses of water.

Example of Poster Content



Project Budget – Materials

- Ten American Legion hall rental
  - For Each: Six two hour sessions @ $75.00.....$4,500.00
- Advertising pamphlet printing
  - 2000 copies @ $0.15.....$300.00
- Ten sets of seminar pamphlets (7 types)
  - For each set: 9 x 500 double sided copies @ $0.20.....$900.00
- Posters for seminars
  - For each location: 4 posters @ $10.00.....$400.00
- Demonstration materials
  - Low-flow shower heads 10 @ $7.95.....$79.50
  - Low-flow toilet 10 $150.00.....$1,500.00
  - Regular flow toilets 10 $95.00.....$950.00
  - Faucet Aerators 10 @ $2.50.....$25.00

TOTAL for Materials.....$8,654.50

Projected Budget – Staff

- Ten session coordinators/lecturers
  - 12 hours @ a salary of $75.00/hour.....$9,000.00
- Support Staff: Three assistants per location
  - 12 hours @ a salary of $10.00.....$3,600.00
- Training Sessions.
  - Five sessions @ $500.00.....$2,500.00
- Total cost for Staffing.....$15,100.00
- OVERALL TOTAL.....**$23,754.50**

Questions and Comments

For more detailed information regarding my research please see me for a copy of my proposal and list of references.

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New Training Program for General Chemistry Department of Accutest Laboratories

Sabrina Miller
General Chemistry Analyst
Monday, April 16, 2001

Outline

- My interest in this project
- The problem with the current training methods
- Success stories of other companies
- My plan for Accutest
- Budget
- Potential Problems
- Summary
- Questions?

Why I Chose This Project

- My personal experience at work
- The high turnover rate at Accutest
- Dissatisfaction among employees

Problem With Current Training Methods

- Training time insufficient
- Lack of structure
- Insufficient safety training
- Trainers unsure of timeline
- Little/no feedback to managers
- Costly errors

Problem With Current Training Methods

Survey (Feb 2001)

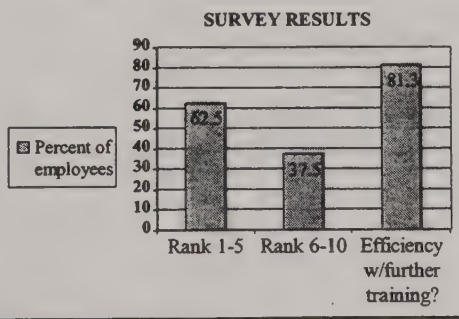
Sample questions:

How would you rank Accutest's (Gen Chem) training methods/program? (please circle)

(poor)1 2 3 4 5 6 7 8 9 10 (excellent)

Do you feel that you would be more efficient if you received further training? Yes___ No___

Problem With Current Training Methods

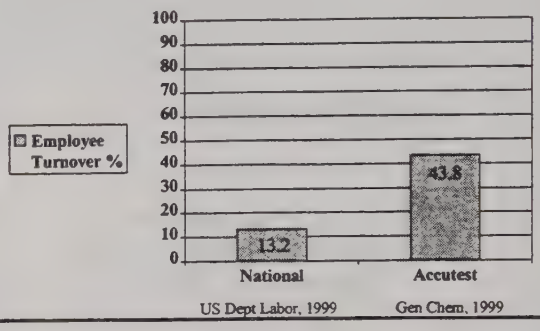


Problem With Current Training Methods

"Companies with the better training methods tend to have a lower turnover number overall. Your company is only as strong as your weakest employee therefore it is in your best interest to keep developing your team to ensure that you are ahead of the game"

Laura Michand, *Turning the Tables on Employee Turnover*

Problem With Current Training Methods



US Dept Labor, 1999 Gen Chem, 1999

Success Stories of Other Companies

Dow Chemical, Edward Jones, Great Plains, Lenscrafters, Sears, Southwest Airlines and South African Breweries were compared to the United States' 500 benchmark companies:

Strategy: More hours spent on training
More payroll percentage on training

Results: Higher employee satisfaction
Lower turnover than industry average

(Helen Lippman, *Retention, Training, Recruitment, Personnel Policies and Job Satisfaction*, 2001)

My Plan for Accutest

Safety, training, practice and evaluation

- One day safety training by senior analyst
- Nine day training period including test runs
- Evaluations of trainer and trainee at the end of training period submitted to manager
- Approval made by manager
- Copies of evaluations filed

Budget

Salary for senior analyst to train one employee on safety for 8 hours	~ $135
Salary for analyst to train one employee for 9 days/72 hours	+ ~ $865
Salary for new employee training w/o benefit of production for 10 days/80hrs	+ ~ $846
Salary for manager to evaluate forms for one employee (~1 hour)	+ ~ $24
Total cost per new employee	= **$1870**
HOWEVER, Accutest's average loss on turnover of one employee in 2000	~ $8,000

Potential Problems?

- Production slowed
- Turnover remains the same
- Better trained employees lured away by competitors

Summary

Problem	Solution
Training time insufficient	Establish two week training period
Lack of structure	See above
Insufficient safety training	One day devoted to safety training
Trainers unsure of timeline	Everyone informed of two week period
Little/no feedback to managers	System of evaluation forms
Costly errors	Pre-tested analysts

ACCUTEST.

Questions?

Chapter Eight

The Project Proposal

The Assignment

The project proposal is the final draft of the project you have worked on all term. Like the presentation, it should be a leadership statement that puts information into action by proposing a research-justified solution to a well-defined problem. Unlike the presentation, though, it should take a specific form (which is laid out below and illustrated in some of the sample papers which follow). The guidelines for preparing this final paper will probably not conform to those of your work place or those spelled out for specific grant applications you might be considering. These guidelines, though, should be readily adaptable to any "real-world" submission. We encourage you to revise your final project for submission in your work place or in your future graduate work, but for the time being focus on fulfilling the requirements of our class.

Remember that the heart of the proposal is a problem, paradigm, and plan which work together to create a unified concept. The paradigm should grow organically out of the way you define the problem, and the plan you present should be clearly rationalized by the paradigm. If you unify and focus your argument, you will be able to present a well organized and logical paper.

The final draft of the project proposal should be approximately 20 pages (inclusive), single spaced. You should also try to do the following (along with anything else your instructor chooses to emphasize):

- Strive for a consistent and professional tone throughout.
- Number your pages clearly (according to the order explained below)
- Unify your paper as best you can using rhetorical, design and signposting strategies.
- Use clearly distinguished headings and subheads to help guide your reader through the parts of each section.
- Use bullets or numbers to list items for easy comprehension.
- Label and number all graphs and figures for easy reference.
- Unify the paper with a consistent typography and style.
- Polish your writing for style and emphasis.
- Proofread for errors in spelling, grammar, and syntax.

The Parts of the Proposal

The formal aspects of the final proposal help you to present your overall argument in a way that is useful for your reader. There are thirteen parts of the project proposal, most

of which should be labeled and presented in order (with the exception of visual graphic aids, which should ideally be incorporated into the body of the paper with individual titles):

1. Transmittal Letter (or Cover Letter) -- generally one full page (not numbered or titled)
2. Title Page -- one page (not numbered or titled)
3. Abstract -- one page (Roman numeral "i")
4. Table of Contents -- one page (Roman numeral "ii")
5. Table of Figures -- one page (Roman numeral "iii")
6. Introduction --generally more than two pages (beginning with Arabic numeral "1")
7. Research (or Literature Review)
8. Plan (or Procedures)
9. Budget
10. Discussion (or Evaluation Plan)
11. Bibliography
12. Visual Aids, Graphics, or Figures—incorporated into the text when possible
13. Appendix (if necessary)

1. Transmittal Letter (or Cover Letter)

Like the cover letter that accompanied your resume, the letter of transmittal is intended to explain and interpret the attached document. It should explain why the reader has received your proposal and it should try to persuade the reader to examine it closely, offering details about the content intended to interest or intrigue him or her. The letter of transmittal should respond to the situation of reading and answer the reader's likely questions: "Why is this on my desk?" and "Why should I read it when I have a dozen other things to do?"

The transmittal letter can take the form of a letter (for a reader outside of your organization) or memo (for a reader within your organization). While an increasing number of transmittals are written in e-mail form, where the proposal is usually an attached file, we ask that you adhere to the traditional paper forms for the purposes of the course.

If it is a letter, it should follow the full block style, in which all of the elements are flush with the left margin in this order:

- Return Address (your name and address)
- Date (for the purposes of the class, use the due date of the final proposal)
- Recipient's address (including name, title, organization, and business address)
- Salutation ("Dear" plus formal address and name)
- Body (see discussion below for guidance here)
- Closing ("Sincerely") and signature

If you are using company stationery, then you will not need to include your address.

If it is prepared as a memo, then it should be written on company stationery (or facsimile) and prepared in memo form:

- To: Adressee's full name, title
- From: Your full name, title or position -- with hand-written initials
- Date: Today's date
- Subject: A line indicating your proposal topic (not necessarily the same as your title)
- Body (see discussion below for guidance here)

Many of the rules for writing the cover letter to accompany your resume obtain here. Since your imagined reader probably attended your presentation (or, at least, you created a context where he or she was imagined in the room), you may want to begin by reminding the reader of that event, explaining that this is the full version of that proposal. Whether or not you have met your reader before, begin by explaining why you sent him or her your proposal and why it should be of interest. Emphasize what you know about the reader's interests and emphasize the chief way the proposal matches those interests.

The central paragraph (or central two paragraphs) should offer an overview of the project, highlighting salient details about the problem, paradigm and plan. Again, point to those aspects of your project most likely to interest your reader.

The final paragraph should invite further contact, offering the most convenient way for the reader to get in touch with you (perhaps by phone or e-mail).

2. Title Page

The page should include the following information:

- Project title
- Submitted by: Your full name and title (or position)
- Submitted to: Your addressee's full name, title, and business address
- Date

You should also indicate somewhere near the bottom of the page what course this paper was prepared for, your instructor's name, and any class information your teacher requests. (This way if your paper gets lost it won't end up on the desk of the imagined audience but will have a chance of getting returned to your instructor).

The title of your project should be carefully chosen and crafted for maximum communication in the shortest space. It is one of the first things the reader sees of your report, and will become the means of referencing it to others. The more communicative power it has the more effective it will be. Strive for to be both clear and memorable.

Remember that you can use a two part title, especially if you want to give your project a catchy title followed by a more technically specific one.

There are many ways to design the title page, and you should do what looks and works best for your specific project. Use white space, color and other page elements to design an attractive image that is consistent with the document design as a whole. You might want to use graphics or pictorial lettering to highlight your topic.

3. Abstract

The abstract should be clearly labeled as an "Abstract" at the top of the page and should be no more than one or two paragraphs in length. The purpose of the abstract is to tell busy people (or their secretaries) how to file your report. It should be written from a disinterested perspective, providing a balanced view of the project idea as though written by an outside party. Usually it is written in the third person or uses passive voice to avoid naming the agent. For the purposes of this class, you should write a relatively long, informative abstract that includes details about your overall argument and covers elements of the problem, paradigm and plan (in that order). Be sure to indicate your rationale and what specific action you want to take. Strive to be maximally communicative within minimal space -- generally between 150 to 300 words.

4. Table of Contents

Clearly label and design your table of contents for easy use. Recognize that the table of contents has two main uses: it helps readers locate the information that interests them most (this is especially true of long reports) and it gives your reader an overview of the project and its parts. You should list all parts of the project listed above (excluding the transmittal letter and visual aids), along with any important subheads. Number the opening parts (abstract, table of contents, table of figures, and executive summary) with small Roman numerals (i, ii, iii) and then use Arabic numbers (1, 2, 3) beginning with the "introduction" section. Use whatever design elements you can to help make the information clear and usable -- indenting subheads, using ellipses to link section names and page numbers, and aligning all related parts. The style and font should be consistent with the design throughout your document.

You can work up a table by carefully laying out the items in it, but many word processing programs will generate a table for you. In WordPerfect for Windows, for example, look under the Tools menu. In other programs, consult your manual or Help menus.

5. Table of Figures

If your table of contents is short, you might include your table of figures (clearly labeled) on the same page. Otherwise, it should occupy its own page. Ideally, each figure and illustration you use should have a number for easy reference. List the number and title of each figure along with the page on which it appears.

6. Introduction

There are two purposes of the introduction: to present information about the problem you will address and to forecast your overall argument. Here is where you will want to offer all the information you have on the problem you seek to address. You should try to quantify or define the problem and offer images that help clarify and emphasize the key aspects of it. Focus on those aspects of the problem that will most interest your reader, and suggest by the way you examine or define the problem a direction for approaching it. Close the introduction with a forecasting statement giving your reader a sense of your argument to follow and providing a transition to the next part.

7. Research (or Literature Review)

The research section should open with some reference to the problem (especially by way of transition from the introduction), but should focus mostly on the paradigm for your project. The research you present should explain why you will approach the problem in a particular way; it should also provide a unified rationale for the specific plan of action you describe in your plan. Thus the paradigm is essential for unifying your paper because it shows how the plan of action you will propose is a logical approach to the problem you have defined.

While each of you will have to explore research in a way unique to your topic, all of you should strive to show that you are not merely asserting your approach to the problem based on opinion, politics, or personal view, but that there is a consensus of opinion or a well-documented trend or development that supports your idea. You might discuss examples of similar or related projects you are using as models, focusing on the procedures and plans that worked in those instances and emphasizing the positive results achieved. You might discuss theories that form the basis for your assumption that the plan you have in mind will be effective -- offering evidence and authority to show that your plan is responding to a body of knowledge. If you are planning experimental work that grows out of a well-established scientific paradigm, you should review the tradition of work in the field that you are building on in your research. Remember that the main purpose of the research is to justify your specific plan of action. Thus, if you plan to educate people about a specific environmental issue, you will likely want to focus more on an effective way (or paradigm) of educating people than you will on that environmental issue (though you will need research on that as well).

One of the purposes of the literature review is to establish your authority -- which will stand or fall based on the quality of the research you cite. By demonstrating your command over recognized or paradigmatic research, you show that you have the knowledge and expertise to make valid recommendations. You should strive to find the most useful and authoritative research whenever possible, and you should discuss published research (ideally, research that has been subject to peer review). Many projects will, however, call for a wide range of research sources, including articles, books, internet sources, published government statistics, interviews, surveys, field

studies, calculations, and experimental results. You should do your best to evaluate sources and use only the most solid in building your literature review. To use low quality materials in constructing your paper is equivalent to using low quality materials in building a house, and your product will be evaluated and graded (or condemned) accordingly.

8. Procedures (or Plan)

The plan should be as specific as possible and should follow logically from your research. How it is presented will depend upon the specific project you have in mind. If you are proposing a workplace project, you might focus on how your idea will be implemented (perhaps providing a flowchart or time line). If you are proposing to do an experiment, you should lay out the specific procedures you will use. If you are building something, you will want to describe how it will be built and provide diagrams. You might wish to reference research to support the specific choices you are making, though the research section should provide the bulk of your rationale.

9. Budget

The budget should list everything you will need for your project, from salaries to supplies. Some items may require explanation, which you should supply here as well. Arrange the cost of your budget items in aligned accountant's columns to make your addition clear.

10. Discussion (or Evaluation Plan)

Generally your paper should conclude by summing up your project and making a final pitch for its value. If you are proposing a project whose results can be tested in some way, then you should also offer an evaluation plan.

11. Bibliography

This section should list all sources of information cited in your paper in alphabetical order. The bibliography should be prepared according to APA Style, which is covered in the supplementary text for this class and in the APA Style Guide in the Research section of this coursepack. Those who want extra guidance might consult The Publications Manual of the American Psychological Associations (APA), which is available in the Reference section of any campus library under BF 76.7.P82 1994. Or you can consult these on-line sources:

- http://www.apa.org/
- http://www.psych.nwu.edu/psych/people/grad/lampiner/AOIPSYSTYLE.html/
- http://www.wlu.edu/~library/styleapa.html/
- http://swilley.mercer.edu/APADOC.html/
- http://bailiwick.lib.uiowa.edu/journalism/cite.html/
- http://www.wisc.edu/writing/Handbook/DOCAPA.html/

12. Visual Aids (or Figures)

You should have at least three graphic aids that are visual representations of numerical information. These might include graphs, tables, charts, or maps. In addition to these three, you may include drawings, photographs, flowcharts, maps, organization charts, Gantt charts, timelines, diagrams, or floor plans. Each visual graphic aid should be numbered (e.g.: Figure 1, Figure 2, etc.) and should have a title. If the graphic is based on information from a source, then you should have a citation line at the bottom (i.e.: Source: A. Alvarez, 1997.) If you are able to incorporate your graphics into the body of the paper, do so. If you cannot incorporate your graphics, then include them at the end in an appendix or interpaginate them directly following the first reference to them.

13. Appendix (optional)

If you have other information that doesn't exactly fit into your text, you could include it as an appendix (which is literally appended to the end of your document). If you do so, be sure to label each page as a separate appendix (Appendix A, Appendix B, and so on), and list them all under Appendices on your Table of Contents. In the text, help your reader by referring to where they are located, as in [See Appendix A, p. 20].

Proposal for Dover Township EMS

This project's strength lies in the writer's fieldwork and firsthand knowledge of the problems inherent in a volunteer EMS system. Primary research supplements the secondary research well, and she tailors her argument to the needs and concerns of a small town audience. The cost analysis is detailed, as befits a municipal proposal.

450 Rider Court
Toms River, NJ 08755
April 30, 2001

Clarence E. Aldrich III, Committeeman
Dover Township Committee
33 Washington St.
Toms River, NJ 08755

Dear Mr. Aldrich:

I would like to thank you for your attendance at the presentation of my proposal "Implementing a Paid System of EMS in Dover Township." The final draft of my proposal is enclosed. Providing emergency medical services to the residents of Dover Township is important in ensuring their safety and health.

Currently six volunteer squads provide EMS to Dover Township. Unfortunately, the volunteer squads are experiencing membership shortages that make it difficult to effectively provide services during the daytime hours, 6am to 6pm, Monday through Friday. In addition, with the growing population and the increased emergency call volume during the week, the volunteers are unable to adequately provide EMS to the residents. Often, residents must wait approximately twenty to thirty minutes for an ambulance during the week. Many townships have implemented paid systems of EMS to supplement volunteer shortages. In Ocean County, Lakewood and Jackson townships have successfully introduced paid systems using two different models. Both are very successful in that they provide excellent care with a response time under ten minutes. Both systems have received profits. My proposal provides a paid system of EMS for Dover Township that results in effective patient care and municipal profits. Additionally, the plan acknowledges the importance of volunteerism for our town.

I hope you find my proposal reasonable and appealing. Thank you for your time and consideration. Please feel free to contact me at xxx-xxx-xxxx if you have any questions or if you would like to further discuss my proposal.

Sincerely,

Christina J. Sorensen
Enclosure

Implementing a Paid System of EMS in Dover Township

Submitted by:
Christina J. Sorensen
Certified EMT

Submitted to:
Clarence Aldrich
Mayor of Dover Township
33 Washington St.
Toms River, NJ 08753

April 30, 2001

Final Proposal for Scientific and Technical Writing
If found, please return to:
Barbara Hamilton
Department of English
Rutgers University

ABSTRACT

Due to the recent population growth and lack of volunteers during the daytime hours, Monday through Friday, 6am to 6pm, the residents of Dover Township have to wait an average of twenty minutes for an ambulance to respond to an emergency call. In addition, the funding to the volunteer squads has been cut. Studies have shown that quick response times greatly improve the rehabilitation and survival rates of patients in most emergencies, and that delay greatly jeopardizes the health of the patient. Many townships are beginning to implement paid systems of EMS due to similar problems with the lack of volunteers. Within Ocean County, Jackson Township and Lakewood Township have both implemented different models of paid systems, and both are very successful. Each township has been able to keep response times under ten minutes, a very important criterion for the health of a patient. This proposal suggests an implementation plan of a paid system of EMS in Dover Township that will allow quicker response times to emergencies. By having the township provide its own service, a profit will be gained for each year of operation. The proposed system will also keep the volunteers active in the community.

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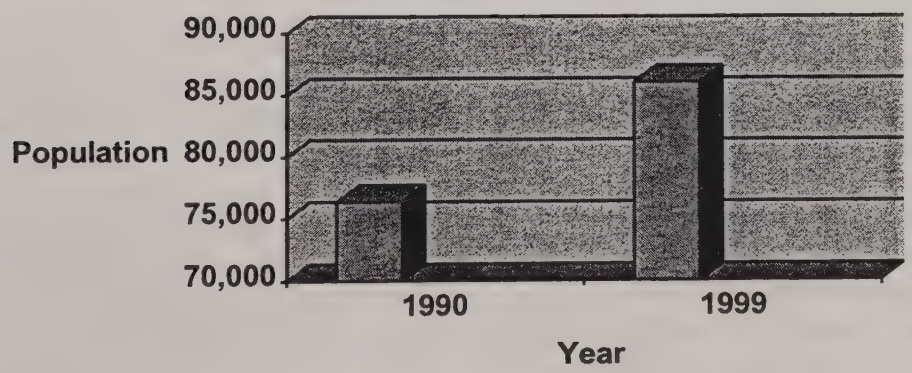
INTRODUCTION

When most people establish residency in a town, they are trying to ensure that their family will live in a safe and secure environment. From the post office to schools, grocery stores, and police departments, most of their needs are met within the town. Most people never think that they will need to call for help; but when they do, they expect an immediate response. When a person is faced with a medical emergency, one minute can feel like an hour. Everything in the patient's world comes to an abrupt stop, and depending on the emergency, his or her life may be threatened. The person expects his or her town to provide the personnel to treat the emergency, and he or she believes that the trained individuals are available day and night. Unfortunately, this is not always the case in Dover Township. Currently, the township's volunteers provide all Emergency Medical Services (EMS), and due to numerous shortages of volunteers, patient care is now being jeopardized. During the daytime hours, 6am to 6pm, Monday through Friday, there is an average of two (out of the six) volunteer first aid squads available to handle emergency calls. Due to the current system, patients often find themselves waiting for help.

Dover Township is by no means a small town. The 1999 census report indicated that the population grew 12.7 percent between 1990 and 1999. As seen in figure one below, the population consisted of 76, 371 people in 1990, and in 1999, the population grew to 86, 044 people. This was a 9,673-person increase in less than ten years (Ocean County, 1999). With the recent housing developments occurring around town, the population can easily reach 100,000 by the end of this decade. In addition, many people who do not reside in Dover Township do work in the township. This fact also increases the number of people within the town.

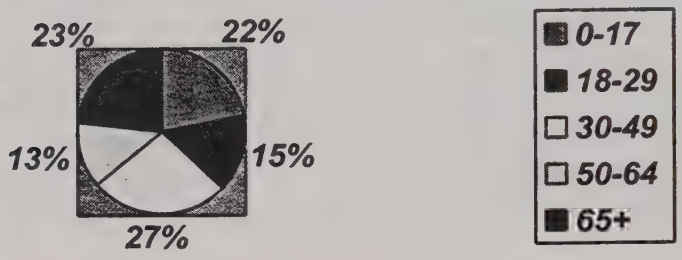
Figure 1: Population Growth in Dover Township



Of the 86, 044 people, there are almost 23,000 people in the fifty or older age group. Most medical emergencies occur within this group of people, and typical emergencies include heart attacks, strokes, or respiratory distress. Most traumas occur in the younger age groups, and include near drownings, car accidents, or broken bones. The following graph represents the age distribution in Dover Township. The graph illustrates

that the near even distribution of people results in a wide variety of emergencies. Not one type of emergency dominates the types of calls the volunteers experience. As a result, the volunteers need to be knowledgeable in all areas of EMS (Ocean County, 1999).

Figure 2: Age Distribution of Dover Township



This graph does not factor the ages of people who only work within the town or are visiting. An increased number of people simply driving through the township, especially in the summer months, augment the potential number of motor vehicle accidents. Most work-related injuries in Dover Township are also not represented in the graph. These two factors contribute to the number and types of emergencies possible. From the two graphs, one can see that there are many people within Dover Township and that there is a wide variety of emergencies. Not having an adequate system of EMS jeopardizes the lives of many people.

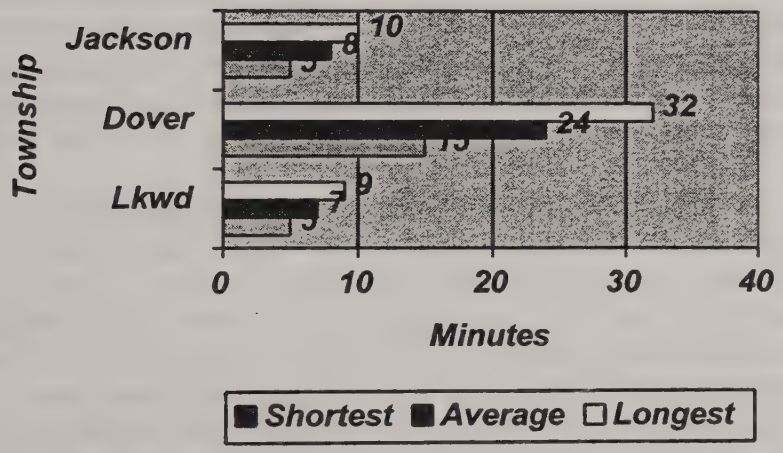
The current status of the system

For the most part, the volunteers have done a great job of providing EMS to the residents of the town. They are able to sufficiently respond during the nights and the weekends. However, from 6am to 6pm, Monday through Friday, the EMS system in Dover Township is almost absent. Under the current system, it is possible for a person to wait 30 minutes for an ambulance to arrive during these hours. Volunteers are not required to wait at their building as long as they can arrive at the squad house within ten minutes of notification of an emergency to form a full crew. A full crew is at least two completely certified EMT's with additional certifications in operating an ambulance. If a full crew cannot be obtained within those first 10 minutes, a second request is made over the paging system by the dispatcher. Again, the same first aid squad has another ten minutes to form a full crew in order to answer a call. If there is still no one available, a third request is made by the dispatcher; but this time, a different first aid squad receives the request to answer an emergency. Now, this new squad has an additional 10 minutes to fill a crew. This process continues until a full crew is able to respond to a call. The dispatcher may use another town or a private ambulance service if no one else is available in Dover Township. When a full crew is finally available, the volunteers now

must drive to the patient, which can take another 10 minutes depending on traffic and distance from the volunteer's building.

In other towns where a paid system of EMS has been implemented, an average response time is under ten minutes, usually around seven minutes, for most calls. Within Ocean County, Lakewood and Jackson have established paid systems. The following table compares the response times of Dover, Lakewood, and Jackson Townships during the daytime hours, Monday through Friday. The data was compiled from Mr. Terry McCarthy (representing services for Jackson Township), Mr. Gar Woodfield (representing services for Lakewood Township), and Mr. Clifford Corbet (a dispatcher for Dover Township) in separate interviews. As one can see from the table, Dover Township has a response time that is roughly three times longer than Jackson and Lakewood townships. Lakewood Township frequently has a lot of congestion on the roadways despite being smaller. This factor tends to lengthen their response time, but usually not by much. Similarly, Jackson Township's response times are lengthened, but for a different reason. While there are not as many people that reside in the township, the overall size is large. Traveling distance often affects their response times. Despite these factors, the two townships are still able to keep response times under ten minutes.

Figure 3: Comparative Response Times



In addition to the ambulance, police officers and paramedics are dispatched to the emergency when warranted. The police officers act as first responders for emergencies, and their main responsibility is to guarantee that the scene of the emergency is safe for the EMT's. Police officers are able to provide basic life support, which includes cardio-pulmonary resuscitation (CPR). Some police officers are certified EMT's and all carry some supplies like oxygen and a defibrillator. Despite the fact that they can arrive at a patient's home within ten minutes, they are unable to provide appropriate means of transportation. Additionally, if the emergency is severe enough, paramedics are also dispatched to the patient. Paramedics will have the adequate training and supplies to properly treat a patient. They have the ability to administer medication through doctor's orders via a radio. Similarly, they do not respond in an ambulance, and as a result have

no means of transporting a patient to the hospital. Consequently, despite the fact that the patient is receiving proper care, he or she still has to wait for the volunteers to provide the ambulance for transportation.

The volunteer squads are faced with yet another problem. Despite being non-profit organizations, the squads still require funding for operations. The funds are often obtained from numerous fundraisers throughout the year and through funding by the District 1 and District 2 Fire Commissioners. In recent developments, the District 1 Board of Fire Commissioners decided to cut $40, 000 in funding to four of the six first aid squads (Mikle, 2001). Each squad had received $10,000 every year to help support their operations, which includes the buying of equipment and the upkeep of the squad buildings and ambulances. Without this money, the ability for the squads to remain operational is now jeopardized. The District 1 Fire Commissioners stated that the squads may receive some funding at the end of the year, if there is any money left over. This will not compare to the $10,000 however. This puts the town at a greater risk of not receiving adequate emergency medical services.

In summary, Dover Township is experiencing many problems with the volunteer system during the daytime hours. The township's response times are roughly three times longer than that of neighboring towns. This mainly results from the insufficient number of daytime volunteers, but also from the growing number of emergencies. In addition, the inadequate funding is causing more problems. By not having enough funds to buy supplies, the volunteers will not be able to provide ample services. Volunteers now must rely more on fundraising to provide extra money for operations. This will prove to be an extra burden on the volunteers. Research and statistics show that the current system in Dover Township can be remedied.

LITERATURE REVIEW

Medical Importance

It is extremely important for a quick response in all types of emergencies. Not only does response time affect the treatment a patient receives, but the survival rate is based upon how quickly trained professionals are able to come to the aid of people. From heart attacks to strokes, car accidents, near drownings, respiratory distress, and other types of emergencies, a quick response time is vital in insuring the survival and proper care of the patient. Even when I was attending the emergency medical technician (EMT) certification program, my instructors stressed the importance of responding to calls in a short time frame. The EMT curriculum emphasizes that in all trauma situations, it is necessary for a patient to arrive at a trauma center within an hour of the incident. This is known as the golden hour of traumas. If patient care is delayed, the survival and rehabilitation of the patient are jeopardized (McSwain, 1997). An important study performed by Brown University (1995) reflects these findings. The study showed that EMS response times under ten minutes resulted in a 9.2 percent survival rate for patients in full cardiac arrest. This number may seem small, but one must realize it is very difficult to save a patient who is in full cardiac arrest. After ten minutes extensive brain damage begins to occur since the brain is not receiving oxygenated blood. With every additional minute, there is a substantial increase in brain damage. If heart function returns to a patient at this time, survival and full recovery is extremely rare due to the brain damage. The researchers also noted that bystander cardiopulmonary resuscitation (CPR) had no significant effect on immediate or ultimate outcomes. Survival was due to the fact that trained professionals arrived to the patient in a short time and were able to provide medical care to save the patient's life.

Another important study, performed by Leslie, Urie, Hooper, and Morrison (2000), analyzed people's ability to recognize symptoms of heart attacks and their responses to these symptoms. The group found that most people do not recognize the common symptoms of heart attacks right away. People tend to believe that their headaches, back aches, and any other signs associated with the problem will go away. In addition, it was found that people are reluctant to call the emergency services since they feel that their symptoms are not serious enough to warrant an ambulance. Only 25 percent of the people studied called for help within an hour of the onset of the symptoms, which was due to the fact that most of the people in this group had a previous history of heart attacks. Forty percent waited more than four hours. Since this is a typical trend with most people, ambulances need to able to respond to emergencies as soon as possible. The study also found that administration of medication within one hour of the onset of symptoms results in a 45 percent reduction in mortality. The reduction of mortality drops to 23 percent when the medications are given within three hours. The addition of longer response times by EMT's to the delays already made by the patient further damage the likelihood for the full recovery of the patient.

Other systems implemented in Ocean County

Other towns in New Jersey and around the United States have recognized a need for paid systems of EMS, and have implemented these systems very successfully. Within New Jersey, numerous towns have made the switch from volunteer-based to paid services. Two local towns, Lakewood and Jackson, have employed different paid systems.

First, Lakewood Township began providing a paid system in 1979 when the volunteers realized that they were unable to provide adequate services during the daytime hours. In an interview on March 2, 2001 with Gar Woodfield, the director of EMS for Lakewood, he stated that the township provides two ambulances, two first responder vehicles, and supplies for the 9 full-time and 15 part-time employees. The township bills the patients' insurance companies for the services provided, and any revenue is returned to the township budget. However, the township only started billing the patients in 1994. The paid service shares a building with the volunteers, who provide services on Saturday and Sunday nights. The township also provides funding for the volunteers. The average response time for all emergencies is approximately 7 minutes, and the longest response times due to distance is 9 minutes. The only problem is the lack of money received from the billing, since a large amount of people in Lakewood cannot afford medical insurance and ignore the bills. Despite this, the township still makes enough money to keep the system operational and gain some revenue.

Jackson Township in New Jersey has also been under a paid system since 1988. The town decided to have a private ambulance service provide EMS during the daytime hours, Monday through Friday. The current company is EMTAC, an affiliate of the Saint Barnabas Healthcare System. According to Terry McCarthy, the director of Southern operations in an interview on March 7, 2001, EMTAC does not require any money from Jackson Township for its services. It provides the township with two ambulance crews Monday through Friday from 4:45 am to 6:00 pm. The company obtains money by billing the patients' insurance companies. All equipment is provided by EMTAC and all revenue is returned to the company. The average response time for the company is between five and eight minutes. There are some response times around ten minutes due to the large size of the township. The volunteers take over during the nights and weekends. The township provides some funding for the volunteers to remain operational. Again, the only problem with the system is the inability for some patients to pay the bills due to the lack of health insurance but this is a loss to EMTAC and not the township.

Other systems implemented in the United States

Other townships in the United States have been able to implement paid systems of EMS, even on a multiple-community basis. First, in Oakland County near Detroit, Michigan, seven communities banded together to contract with one private company (Feighan, 2000). It resulted in better services and lower cost to the taxpayers by creating one large service. The merger even allowed for more resources, quicker response times, and better training for the employees. Next, Lawrence Leonard (2001) reported on a

remarkable case in Texas where an air ambulance service was implemented for 15 counties. Since the area suffered from large hospital closures, a cost-effective helicopter service was implemented in order to provide EMS to the residents. After several options were evaluated, a hospital's administration decided that a company willing to supply a helicopter, pilots, and maintenance would provide the air ambulance service. The company would bill the hospital for their expenses while the hospital would provide the medical personnel, medical equipment, and landing site. The service started in 1994 and is still currently operational. The two examples reflect how an ambulance service was needed on a large-scale level, and was implemented successfully.

Avon, Connecticut is experiencing a similar problem with volunteer firefighters where there are simply not enough to support the town. However, this has not always been the case given that there used to be a waiting list for volunteers since there were so many eager to join the fire departments. Unfortunately, signs begging for volunteers have replaced the waiting lists. As a result, the Connecticut State Firefighters Association has established a task force to recruit volunteers. A statewide recruitment campaign is urging the Office of Emergency Medical Services in Connecticut to adopt a similar recruitment program since the need for volunteers has become critical throughout the state (Axelbank, 1999). Waldrof EMS is also experiencing a shortage of volunteers in Charles County, Maryland. In 1995, there were almost 5,000 emergency calls, which was an all time record for the town. To combat the growing number of emergencies, another volunteer squad was added to the township. This alleviated the problem somewhat, but in 1999, the number of calls jumped to roughly 9,000. The squads do not wish to implement a paid system, and are currently looking for new methods to attract volunteers while retaining the current ones. Unfortunately, there is still a lack of volunteers as the town grows (Reel, 2000).

A recruitment plan is not the answer Dover Township should be considering. Actually, it is already in progress in the town to preserve volunteerism. This is being conducted by the Mayor's Commission on Volunteerism, and was started in August of 1999. Despite the actions by the committee, there is still a shortage of volunteers in Dover Township. The six first aid squads have been trying to recruit members for several years now. While some attempts gain a few members here and there, it is still not enough to support the large volume of EMS calls during the daytime hours. Furthermore, most of the new members must pass the six-month certification program along with other requirements by the squad before they are able to practice their EMT skills on an emergency call. Therefore, the few members that do join due to the recruitment attempts usually have to wait several months before they can fully participate as volunteer EMT's. It is important for townships to provide emergency services to its citizens. Dover Township would benefit the most by merging the systems under Jackson and Lakewood. Dover Township has the ability to provide its own services (like Lakewood) during the daytime hours, Monday through Friday (like Jackson).

PROPOSAL

From the research conducted, it is important for Dover Township to establish a paid system of EMS as soon as possible. This system can either be provided by the township or by a private ambulance company. Despite the effectiveness of a private system, Dover Township will benefit more if it establishes its own ambulance service. All of the profits would go to the township instead of a private service. Furthermore, the volunteers will remain an important element to the system. Overall, the township could benefit greatly.

The goal of the proposal is to implement a paid system through the township by no later than January 1, 2002. Initially, two ambulances will be operational Monday through Friday from 6am to 6pm, and the volunteers will continue to cover the town on nights and weekends. Each ambulance crew will consist of two EMT's. The EMT's will be required to arrive to work at 5:45 am in order to make sure the ambulances are properly stocked with supplies, fueled, and operational. The crews will be able to respond to emergencies at 6am. The ambulances and an office will be stationed at Police Headquarters, which is roughly the center of town. The office will store the supplies and allow workers to conduct the necessary business. At all times, the EMT's will be in the office or in the ambulance when they are not responding to calls. In addition, since there will only be two ambulances initially and since the township tends to be very busy some days, the volunteers will respond to some emergencies when the two paid ambulances are already responding to an emergency. This will ensure that no patient will have to wait more than ten minutes for an ambulance. The volunteers will not lose any of their equipment, ambulances, or access to their buildings. All additional equipment for the paid service will be provided by the township. The volunteers will remain operational with everything they are currently using. Furthermore, police officers will continue to be first responders to an emergency call. This will ensure that the scene of the emergency is safe for the EMT's. Also, paramedics will respond to emergencies when warranted. Their additional training and medications will be needed on certain types of calls.

At first, there will be eight full-time employees. Four full-time EMT's will work three shifts a week, with each shift being 12 hours in length. The full-time employees will also consist of two people for billing and other office work and two supervisors (one for EMT's and one for billing). The office personnel will be mainly responsible for sending the appropriate information to patients' health insurance providers to receive payment, and to evaluate the patients' charts to ensure that the EMT's have properly completed them. The billing supervisor will oversee this operation. The EMT supervisor will make certain the medical supplies are always in stock and that all of the EMT's are up-to-date with their certifications. As the service expands, the EMT supervisor will also train new employees in the system. The supervisors and office personnel will work five days a week for eight hours. Additionally, there will be eight per diem employees. Four EMT's will work the additional 2 days each week, and two EMT's will be able to fill in for people when they call out of work. One per diem employee will work in the office while another per diem employee will be available to repair the ambulances and equipment when necessary.

The following figure provides the billing information each patient will receive. Again, the patient's health insurance company will be billed; and 99 percent of the time, the company pays the bill in full.

Figure 4: Billing Information

Charge for BLS transport (flat rate).....$300.00 per patient

Loaded Mileage.....$5.00 per mile

Oxygen Use.....$50.00 per patient

Cervical Collar.....$17.00 each

Each patient will be billed a flat rate of $300.00 per transport. In the event that the patient decides not to be transported to the hospital, this flat rate will not be charged to the patient. For every mile the patient is in the ambulance, from his or her location to the hospital, there will be a charge of $5.00 per mile. If the patient needs oxygen during his or her transport, a flat rate of $50.00 will be charged; and if the patient needs a cervical collar, another flat rate of $17.00 will be charged. If the patient does not need oxygen or a cervical collar, the two rates will not be charged to the patient. The purpose of charging the patient is to offset the expenses the ambulance service will have for being operational. As one will see from the budget, a profit can be obtained for the township.

BUDGET

Expenditures (First Year)

(1) Employees

Full-time	$272,000
Per Diem	$120,000
Dispatchers	$0

(2) Supplies

Medical	$30,000
Defibrillators	$10,000
Gas for ambulances	$0
Office Supplies	$18,000

(3) Ambulances $250,000

(4) Uniforms $3,560

(5) Aid to Volunteers $335,000

(6) Insurance $100,000

(7)TOTAL $1,138,560

Profits (First Year)

A. Gross Profits	$1,200,000
B. Net Profits	$61,440

Profits (Subsequent Years)

Net Profits $325,000

Budget Justification

(1) Employees: For the full-time employees, the 4 EMT's and the 2 office personnel will receive $32,000 a year. The 2 supervisors will receive $40,000 a year. These figures include benefits. For the per diem employees, each person will receive $12.00 per hour, and this figure does not include benefits. The township already provides the dispatchers, and therefore, this is not an additional expense to the town.

(2) Supplies: All of the medical supplies include items like oxygen, cervical collar, various types of gauze, etc. One defibrillator is required for each ambulance at a cost of roughly $5,000. Gas is already provided by the township, and therefore, is not an additional expense. Office supplies include computers and paperwork.

(3)Ambulances: Depending on certain models, ambulances usually cost around $125,000. Since the township needs two ambulances, the above estimate is reached.

(4) Uniforms: The uniforms will be worn by the EMT's. Pants usually cost around $50.00 per pair, a polo shirt for the summer usually costs $30.00, and a long sleeved dress shirt for the winter usually costs $35.00. The full time EMT's will receive three of each while the per diem EMT's will receive two of each. In addition, each EMT will receive an all-weather jacket, which costs approximately $80.00 per jacket. Discounts are usually given when uniforms are bought in bulk. With embroidery, the above estimate is reached.

(5)Aid to Volunteers: Since the volunteers are currently losing funding, this figure provides the six volunteer first aid squads with roughly $55,000 a year.

(6)Insurance: The insurance is needed in case one of the employees is injured while working. For example, if an EMT hurts his or her back while lifting a patient, this money will pay for any medical bills and therapy needed by the EMT.

Profits: There are approximately 4,000 emergency calls in Dover Township from Monday through Friday, 6am to 6pm. If only the flat rate was charged to each patient, a total of $1,200,000 will be grossed for the township each year. This is the least amount of profits since loaded mileage, cervical collar and oxygen use are not considered. By subtracting the total expenditures from this amount, a net profit of $61,440 will be the least net profit for the first year of operation. In the second year of operation, the ambulances and the defibrillators will not need to be purchased again. Some uniforms may need to be replaced. If these expenditures are added to the net profit from the first year, the second year net profits approximately will be $325,000. There are some people in Dover Township that will not be able to pay their bill due to a lack of medical insurance. This problem will not affect the profits since most residents do have health coverage.

DISCUSSION

It is important to have an evaluation of the implemented system, especially during the first year of operation. Since police officers will continue to be first responders for the patient, they will be able to evaluate the effectiveness of the system. On a simple documentation sheet, the officer will note the type of care the patient received and how well the two EMT's worked together. If the ambulance crew does not provide adequate patient care or if there are conflicts between the EMT's, the evaluation sheet will allow the EMT supervisor to improve on any problem areas within the system. In addition, the dispatchers will record the response times of the ambulances to ensure the crews arrive to the emergency under ten minutes. A police liaison will periodically meet with the EMT supervisor to discuss any problems. If necessary, the ambulance crews will also be involved in the meetings in order for all problems to be worked out. Under this evaluation process, the paid EMS system will be able to operate at its full potential.

In conclusion, the implementation of a paid system of EMS provided by Dover Township will be very successful in that it will provide immediate patient care, gain profits for the township, and preserve volunteerism. The profits will allow the paid system to remain operational. As the net profits increase in the second year, it is recommended that the system is expanded with the revenue, and wage raises given to the existing employees. Since the population of Dover Township is constantly growing, a third ambulance will most likely be needed within a few years. This will require more employees and supplies. If the net profits are saved, the additional expenditures will not damage the service, and it will be able to remain operational. If the system does not need to be expanded, the profits can be applied to the township. Improvements on roads, schools, libraries, or any other areas can be made with the net profits received.

The system will also allow volunteerism to be preserved. This implementation plan is not trying to replace the volunteers. They have provided the township with an excellent service for many years. Unfortunately, population growth and lack of volunteers are resulting in delays in patient care. This implementation plan is simply helping the volunteers. They will still be able to participate, even during the hours the paid service is operational. Together, the volunteers and the paid service can provide an exceptional service to the residents of the township. Response times less than ten minutes are extremely important for the patient's recovery and chance of survival. There is no reason that patient care should be delayed, especially with a paid system of EMS. This is the most important reason for implementing a paid system. After all, the health and safety of the population of Dover Township should be the top priority.

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Proposal for Mercury Bioremediation

Erwin started the research process with an awareness of the problem, but a rather unrealistic plan. He worked to find the best sources and a good model to serve as his paradigm. Interesting graphics, good details, and a well-reasoned argument result in an attractive, informative, and convincing proposal.

Erwin Mialkowski
2020 Myopia Drive
Searsville, IA 77777
April 20, 2001

DNSC Director of Environmental Management
8725 John J. Kingman Rd., Suite 4616
Fort Belvoir, Virginia 22060-6223

Dear Mr. Reilly:

I would first like to thank you for taking the time to come see my presentation on the South Somerville Depot. As promised at that presentation, I am sending you a complete report detailing the problems and possible solutions at this installation. A level of urgency has developed in this situation due to the mercury contamination of privately owned land surrounding the military installation. My proposal is aimed at cleaning up this contamination, as well as helping to contain the mercury stored at the site to prevent future problems from occurring.

Currently the South Somerville depot has levels of mercury contamination 800 times that of the safe limits established by the EPA. The mercury has seeped into the ground water and caused contamination of private drinking wells in the area. This posses a great health risk to the residents of Hillsborough, NJ.

The EPA has already put forth a monetering program, to better define the mercury problem at the South Somerville Depot. Once testing is completed they will decide on a course of action to clean up the mess. Most likely, the solution will be to remove the soil and treat it as toxic waste.

However, with the recent advances in biotechnology cleaning up this problem would be both easy and cost effective. Plants have been developed that are extremely effective at removing metals from the soil. These plants not only work well, but their use is very cost effective when compared to other means of cleaning up mercury.

There have also been advances in the storage of hazardous materials, some of which such as rubberized floors have already been implemented at the South Somerville Depot. However, more safety measures are needed in storing a chemical as dangerous as

mercury. Air filtration of enclosed space used to house mercury is vital in containing the compound.

The mercury problem in Hillsborough is a threat to the community. My proposal offers a quick and cost effective solution to this threat. Please contact me at 908-371-0096 with any concerns or questions regarding this proposal. I look forward to speaking to you again.

Sincerely,

Erwin Mialkowski
Enclosure

Mercury Contamination At the South Somerville Depot

Submitted by: Erwin Mialkowski

Submitted on: April 23, 2001

Submitted to: Col. Reilly
DNSC Director of Environmental Management
8725 John J. Kingman Rd., Suite 4616
Fort Belvoir, Virginia 22060

Abstract

The South Somerville Depot, located in Hillsborough, NJ, has been a chemical storage dump since its inception in 1941. Its primary objective was storing chemicals needed in the production of military hardware. Since accessibility to these chemicals was the top priority, the safe handling and storage of these chemicals was considered a secondary objective. Due to lax safety measures associated with the handling of these often toxic compounds, spills were a common occurrence. As a result of the spills, the grounds of the depot have concentrations of mercury up to 800 times the EPA's safe limits. In recent months, it has been documented that the mercury has spread past the depot grounds and affected nearby ground watersheds. The proposal acts in two parts: The first part secures the stored mercury against any future release into the environment. The main objective is to eliminate the release of mercury vapor into the air, with the aid of a newly developed filtration system. Once the stored mercury is secured, the process of cleaning up the contaminated soil can begin. The second part of the proposal uses a biotech process known as phytoremediation to remove the mercury from the soil. This process involves genetically engineered plants absorbing the toxic compound and metabolizing it to a safer form. This program has the potential to not only clean up the current problems at the depot, but also to secure it against future mercury contamination problems.

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Introduction

The South Somerville Depot, located in Hillsborough NJ, is a part of the Defense National Stockpile Center (DNSC). The DNSC is a network of strategically placed military installations, which function as storage areas for materials needed in the production of military hardware. The storage areas, or depots as they are better known, are located near industrial centers to provide easy access to the materials that they store. The South Somerville Depot has been a part of this network since its inception in 1941. Among its wide variety of stored chemicals is the world's largest supply of mercury (Kamel, 2000). Mercury was once used in a wide variety of industrial processes and was therefore needed in large quantities. It was also considered a harmless chemical, and was therefore not stored with great care. As a result of the haphazard handling of this compound, a large amount of the chemical was spilled into the soil. Once in the soil, the mercury penetrated the earth and entered the ground water table. As a result, the South Somerville Depot's grounds and the surrounding area have become contaminated with the compound (Kamel, 2000).

Over the last two decades, mercury has been proven to be a toxic compound that causes a variety of health effects in both humans and animals. Its use in industry has been widely curtailed, and the proper handling and storage of the compound has become a priority. Hillsborough is now forced to deal with a serious mercury problem due to improper handling of the substance over a span of several decades. The South Somerville Depot currently contains levels of mercury contamination 800 times the EPA's established safe limit (EPA, 1992). Such high levels of mercury contamination pose a great threat to the surrounding community. The mercury stored at the South Somerville Depot needs to be contained, and the contamination of the soil in and around the installation must be cleaned up.

History and Location of The South Somerville Depot:

At the onset of World War II, the United States military realized that it was lacking in military equipment, the means to produce that equipment, and the facilities needed to store the raw materials used in the production of military hardware. The DNSC was created to handle the challenges associated with the procurement, storage, and distribution of raw materials needed for the war effort. It created a network of storage facilities located near industrial areas to handle this problem. One of the sites chosen by the DNSC to store needed materials was Hillsborough, NJ. Hillsborough was chosen since it offered a variety of potential benefits for such an installation (Kamel, 2000).

First, Hillsborough is located in central NJ, only 40 miles away from New York City. New York City contained the largest port on the east cost, and the majority of military hardware bound for Europe left from there. Hillsborough is also located near shipyards and industrial areas in Philadelphia, eastern New Jersey, and New York State. Secondly, vital infrastructure, such as roads and rail lines, already existed in the area. The infrastructure was needed to facilitate the quick transportation of the raw materials to the industrial locations where they were needed.

Finally, at the time, Hillsborough was a rural community with a small population. The proposed site for the depot was surrounded by a few farms and several small towns. Within 25 miles of the site there were only 20,000 inhabitants (US, 2000). This was also a factor because, if any spills occurred at the depot, a large population would not be exposed to any chemicals. The location of the depot, along with the surrounding infrastructure is illustrated in Figure 1, page 3.

Once the site in Hillsborough was approved, construction of the depot began. The installation was built quickly, with accessibility as the primary concern. Unfortunately, containment of the chemicals and the safe handling of these chemicals was a secondary concern. Figure 2, page 4 is a detailed map of the South Somerville Depot. The Depot itself consists of 4 large warehouses, several chemical storage pits, 6 open concrete fields, and numerous support buildings. Mercury was stored in two main areas; the chemical pits and the first warehouse. When the substance was needed, it was placed into drums and left in the open storage areas until it was loaded onto either trains or trucks. This arrangement provided easy accessibility to the mercury, but the open chemical pits and storage areas provided little protection against spills of the compound. As a result numerous mercury spills have occurred. The spills resulted from 3 main problems associated with the handling of the mercury at the installation. First, the chemical pits were not properly lined and sealed. As a result, when large amounts of mercury were removed or added to the chemical pits some would inevitably spill onto the surrounding soil (Cohen, 1999). The second factor is a direct result of the amount of mercury stored at the depot. Mercury is a liquid substance which, over time, vaporizes into a gas form. The mercury gas is comparatively heavy to the surrounding air, and therefore falls back to earth, causing contamination (Xiaohong, 2000). Since the depot contains the single largest supply of mercury in the world, the amount of mercury gas being released into the atmosphere is quite substantial. Finally, the open concrete fields were not lined with an impermeable surface. Concrete is a porous material, and any mercury spilled onto it travels through the concrete into the soil. The barrels used to store the mercury on the concrete fields would often leak, thus creating a large problem (Caruana, 1995).

EPA Testing:

Worried about possible contamination, the EPA started testing the installation in 1991. The preliminary tests took samples from nine separate locations throughout the depot. The results from their preliminary tests illustrated the extent of the problems with the storage facility. The soil enclosed by the depot's fence contained no less than 18 toxic

compounds (EPA, 1992). Among those toxins were alarmingly high levels of mercury. The results of the mercury testing are shown in Figure 3.

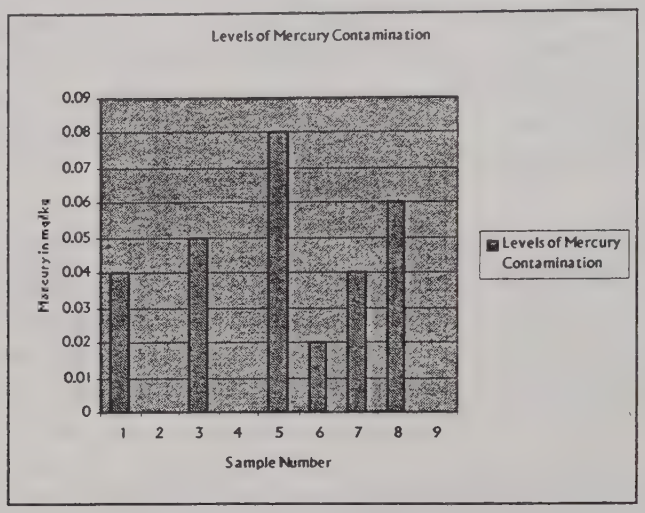


Figure 3. From 1992 EPA/540-R-92.021

Of the nine test sites used to ascertain the amount of mercury in the soil, six samples showed high levels of contamination. The amount of mercury in the test samples ranged from .02 mg/kg to .08 mg/kg. This can be compared to the EPA's safe limit for mercury, which is .1μm/kg. A reading of .08 mg/kg represents an amount of mercury 800 times the established safe limit (EPA, 1992).

Some inconsistencies show up in the test results, since three of the samples did not return any substantial mercury readings. However, there is a simple explanation for this discrepancy. Mercury is a liquid, and will therefore move downhill once released into the ground. The test sites for samples 2, 4, and 9 were all located uphill from where the mercury was stored or handled.

Spread of the Mercury Problem:

Since mercury is a liquid, it has the ability to spread from a contaminated area. This poses a great threat to any land adjacent to a contaminated site. The quickest way that mercury spreads is by contaminating the ground water under the land itself. This is a huge potential hazard since many areas are reliant on ground water for their water needs. Hillsborough is one such an area. With no rivers large enough to support the population, residents of the area are reliant on ground water. Therefore, many wells have been drilled to gain access to this vital resource. Figure 4 is a table showing the number of wells located at various distances from the South Somerville Depot.

Figure 4. Number Of Wells In Relation To the Depot

Distance From Base	Drilled Wells	Dug Wells	Total Wells
0-.25 miles	48	6	54
.25-.5 miles	56	6	62
.5-1 miles	166	13	179
1-2 miles	443	37	480
2-3 miles	778	62	840
3-4 miles	1712	124	1836
Total	**3203**	**248**	**3451**

(Focused Site Investigation Report Somerville Depot; prepared by Patersons Engineering Science Inc. March 2000)

As seen in the figure above, within a 4-mile radius of the base, there are almost 3,500 wells. The dug wells are shallow, created without the use of large industrial drilling equipment. These wells run between 20 and 100 ft deep, and are very susceptible to contaminants near the surface. On the other hand, the drilled wells run several hundred, if not thousands of feet into the earth. Water taken from these depths is usually less susceptible to contamination. However, all 3,500 wells are in danger of becoming contaminated with mercury, which is slowly seeping out of the depot. In recent years the township has conducted annual testing of private wells surrounding the depot. These tests have in fact revealed that the mercury problem is no longer contained within the military installation. There are currently six wells surrounding the depot that have contaminated well water. As a result of these findings, the township was forced to extend its municipal water lines to accommodate these residences.

Changes Over Time in Hillsborough:

Hillsborough has changed a great deal since the South Somerville Depot was constructed. The area surrounding the installation is no longer populated by a mere 20,000 inhabitants. Information released from the United States Census Department indicates that the 25-mile radius around the installation is currently occupied by about 3,000,000 people (US, 2000). The community surrounding this installation continues to grow at a rapid pace. With such a large population, in such close proximity to the depot, it is vital that the stored mercury be handled with the utmost care. Preventing any future release of mercury from this depot is vital to the health and well-being of the community. Cleaning up the problems which have already been caused by the storage of mercury also need to be addressed quickly and decisively.

The reason why the mercury needs to be cleaned up is quite simple; it is toxic to both humans and the environment. It causes a wide variety of disorders that can become serious enough to kill.

Effects on Humans:

Mercury poisoning is a serious medical condition that takes on several forms. The first type of poisoning occurs when a person is exposed to a large dose of mercury over a short period of time. This type of poisoning is known as acute mercury poisoning. The symptoms of acute poisoning start out quite mildly. Coughing, chest tightness, and trouble breathing develop. This is often followed by an upset stomach and body aches. As the mercury spreads through the body, several types of tissue are attacked by it. The first organs greatly affected are the lungs. This type of poisoning often results in very serious cases of pneumonia, which can be fatal. The kidneys are the second major organ affected by mercury poisoning. The kidneys attempt to rid the body of the compound, but cannot do so. The mercury starts to build up in the kidneys, leading to serious damage.

A second, and more serious type of mercury poisoning is the repeated exposure to the substance over an extended period of time. This type of exposure is known as chronic poisoning. The effects of chronic poisoning are very severe, since the neurological effects of the compound can be seen. Mercury is a nerve-toxin, which damages nerve cells exposed to it. The severity of nerve damage is dependent on the time, and amount of exposure. However the symptoms progress as follows: it starts with a fine tremor of the hand, with loss of sensitivity in the hands and feet. Difficulty walking, and slurred speech follow soon after the initial tremors. As the effects of the poisoning progress, tremors start affecting other parts of the body, such as the lips, tongue, and eyelids. Eventually, the nerve damage can lead to paralysis and death. The victim's mental status is also altered as the mercury destroys nerve cells in the brain.
Mood swings, hallucinations, and loss of memory are common results of chronic poisoning. Other effects of chronic poisoning are kidney and liver damage, a reduced effectiveness of the immune system, and malignant tumor formation (Massaro, 1997).

Mercury's effects have the greatest impact on children and infants. The symptoms described earlier progress quickly in small children, and chances of death are much greater. Mercury compounds are known to interfere with fetal development, causing birth defects in children born of exposed mothers. The effects on infants of exposed mothers are often very severe. The effects are mainly neurological, resulting in delayed development and a diminished mental capacity (Massaro, 1997).

Effects on the Environment:

The environmental effects of mercury are also quite severe. Animals in the environment are not able to rid their bodies of mercury. The mercury builds up in their systems, causing negative health effects. This build-up causes an effect known as bioaccumulation, which is the increase in concentration of a substance along the food chain. After mercury enters water, it is first taken up by bacteria and tiny animals such as plankton. The plankton and bacteria are then eaten by small fish. Those small fish are, in

turn eaten by larger fish. Large amounts of mercury accumulate in the bigger fish's body. Not only is the big fish absorbing mercury from the environment, but it is also absorbing all of the mercury that has accumulated in its prey. The final result is that a fish swimming in contaminated waters may have up to 800,000 times the concentration of mercury in its body compared to the surrounding water. Animals and people that consume the contaminated fish are exposed to large doses of mercury in very short period of time (EPA, 1998).

Case Study

Dealing with mercury contamination has become a global problem. Effectively locating and cleaning up contaminated sites has become a concern in many parts of the world. One such contaminated area is the city of Sumgait, Azerbaijan. Sumgait is a city of 350,000 inhabitants located about 30 km northwest of Baku and is one of the most industrialized cities in the former Soviet Union with a number of large-scale chemical and petrochemical plants. Sumgait's industrial zone borders the Caspian Sea, and a large section of the nearby shoreline is severely polluted. Today, production has decreased largely due to an economic recession causing lower demand of the products. A lack of funds has led to a deterioration of the industrial structures and production is now closed or continuing at a limited level for most industrial production. The industrial activities have caused severe environmental contamination of the Sumgait region including the Caspian Sea.

Since 1958, chlorine gas and caustic soda have been produced in Sumgait using a mercury amalgam process. The original SAMIB chlorine plant ceased operation in 1981 when a new chlorine plant was opened. While it was operating, the old chlorine plant used large amounts of mercury, some of which was lost in the sludge by-product or by evaporation, spills or mishandling. There is an estimated 65,000 tons of mercury-rich waste sludge that has been inadequately stored at the site, as well as 40,000 tons of mercury-contaminated soil and building debris from the old plant. These wastes pose a likely risk for ground water contamination, wind-borne contamination, and leakage into the Caspian Sea.

The old chlorine plant was identified as a potential source of mercury contamination in the Sumgait area, and a cleanup component was initiated in order to avoid further ecological damage. This component would demonstrate mercury cleanup methodologies that could be used elsewhere to clean up other sites that have mercury contamination.

The objectives of this component are to: clean up mercury contamination at the old chlorine plant; provide safe and sustainable disposal of the mercury amalgam process' old sludge, mercury-contaminated soil, and building debris from the old plant; and perform an overview of the extent of mercury accumulation in the environment and human exposure in the Sumgait area. The process would be conducted in several stages, as follows.

Testing a Pilot-Scale Sludge Treatment. This is aimed at finding the most efficient method for dewatering or stabilizing the sludge and making it suitable for transport and disposal. The alternative methods to be considered are: drying, stabilization with inert material (cement) and stabilization with materials that remove water in chemical processes (Ling, 1999).

Developing and Applying a Low-Technology Method for Mercury Recovery. The soils at the old factory site are contaminated with mercury in the liquid elemental form, which makes mechanical separation using low-technology feasible. After the mercury recovery, the soils would be transported to the landfill for safe disposal.

Transporting Wastes. The sludge transfer would be done by covered trucks following a designated route, which avoids inhabited area and dangerous roads. Roads along the proposed route would be strengthened, and periodic maintenance would be performed. Bridges crossing canals along the route would be temporarily lined and sealed. Trucks would be inspected to assure that they meet operational and safety requirements on a regular basis. Trucks would be washed before leaving both the work site and the landfill and the resulting waste waters would be treated.

Constructing a Safe, New Landfill. A hazardous waste landfill that meets international standards is being designed for final disposal of the excavated soils, building debris, and sludge. The landfill would be in an area with high clay content soil that has no hydrological links to the Sumgait or Baku water sheds. The landfill would be constructed using a geo-textile lining on the bottom, then a drainage layer, then another geo-textile lining, then fine grain waste, then course grain waste with larger items placed in the center, then a top fill layer, a waterproof cover, and more top fill. Followed by a concrete dig-proof layer, another fill dirt layer, erosion bricks and eventually vegetation. The landfill would be monitored for five years after completion, and any leaks would be repaired under the contractor's five-year guarantee.

Designing and Implementing a Monitoring Program for Mercury Emissions to Air and Water from the Contaminated Site, for the impact of mercury emissions on the Caspian Sea ecosystems and human exposure in Sumgait. This monitoring program would start before the on-site activities begin, and would continue for five years after the completion of the operation, in order to follow-up the expected benefits. It would include equipment for sampling and analysis of mercury in air, groundwater, surface water, soils, sediments, and human hair.

Follow-up Assessment. After the completed removal of the contaminated soil and sludge, an assessment of the need for further actions would be made. Further actions may include stabilization/isolation of any remaining mercury-contaminated material not suitable for excavation (Thompson, 2000).

The total estimated cost for the clean up in Sumgait is $8.1 million US Dollars.

The clean up at Sumgait offers several lessons that can be employed in the clean up of the South Somerville Depot. Ideas pertaining to monitoring, and several clean up methods can be of great help when coping with mercury problems. However, some modifications need to be made for several reasons. First, the South Somerville Depot is a working facility. Any clean up efforts cannot seriously hinder its continued operation. Second the site and levels of contamination are on a smaller scale than the clean up at Sumgait. Finally, the South Somerville Depot will continue to store mercury, and therefore needs to be upgraded.

Improvements at the South Somerville Depot:

The administration at the South Somerville Depot has realized that the mercury contained at its installation needs to be handled with greater care. Several steps have already been taken to better contain the substance.

The first main improvement came about in the early 1970's. At this time the mercury that was contained in open pits was secured into barrels and moved into warehouses. Since that time, no mercury has been openly stored outside. The barrels used to hold the mercury were also upgraded. Single layer metallic barrels are no longer used. Since mercury reacted with the metals in the barrels, over time the barrels would break down resulting in leaks. The new barrels are constructed using several layers. The innermost layer is a polymer, which cannot be broken down due to contact with mercury. The second layer is metallic, which gives the barrel strength, and further acts to maintain the structural integrity of the barrel. The outermost layer is constructed of plastic. The combination of layers makes the barrels very resistant to leakage.

The warehouses used to store the mercury have also been upgraded. The concrete floors that were originally there did little to prevent leaks. Since concrete is a porous material, liquid mercury could move through small cracks and escape from the warehouse. These floors were upgraded in 1991, the floors now are covered with a layer of polymers. If any spills do occur, they remain on the floor and can be easily cleaned up. Materials coming into the base or leaving it were also handled with much greater care. Any trucks used to haul supplies were covered and inspected on a regular basis; trains used for the same purpose were also regulated with strict handling guidelines. The new regulations went a long way towards preventing any spills into the soil (Patersons, 2000) .

All of these measures have substantially increased the level of safety at the base. However, there are some issues that still need to be addressed. As stated before, mercury turns into a gas over time. This process occurs as readily in open pits as it does in sealed containers. It is therefore imperative that measures be taken to clean the air inside the warehouses used to store the chemical. If this is not done, mercury gas will continue to leak out of the buildings, causing contamination. The other issue still at hand is the treatment of the contaminated soil. Once the stored mercury is properly contained, measures need to be taken to clean up the damage that has already occurred.

Proposal

Cleaning up the mercury problem at the South Somerville depot will be an involved process. This process needs to include preliminary testing, a process for cleaning up and containing the mercury, and finally a way to verify the effectiveness of the clean up efforts.

Preliminary Testing

The first step in handling the mercury problem is to determine what quantity of mercury is contaminating the soil. The EPA has already done extensive testing of the facility, and plans on doing further testing in the summer of 2001. The proposed test sites in the next series of tests are shown on figure 2, on page 4. At the current time, levels of contamination are somewhat known. The next round of tests will determine the exact levels, areas, and depths of contamination (EPA, 1992).

The second step in the process involves securing the mercury that is currently stored at the base. This step needs to precede any clean up since, if the soil is cleansed before the mercury is completely secured, the ground has a chance of becoming contaminated once again. The coated floors and reinforced barrels offer a good level of protection against any spills that could occur. However, as stated before, nothing has been done to treat the air inside the warehouses. The contaminated air leaving the warehouses could deposit mercury in the earth once again. Therefore the air issue needs to be addressed first.

Mercury gas is a large molecule when compared to other substances in the air. It is also a very reactive compound. These two characteristics play an important role in the isolation of mercury from the air. New air filtration systems have been developed which are very effective at reducing the amount of mercury in confined areas (Markota, 1997).

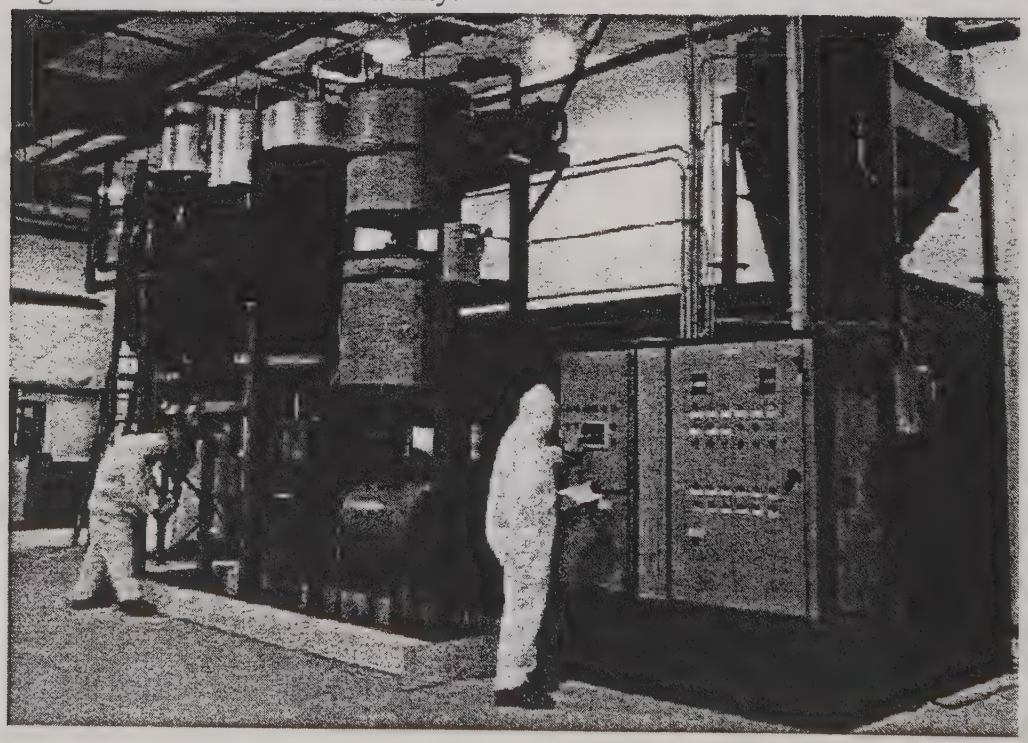
The Filters:

The filters themselves are placed on the roofs of already existing buildings. Large air inlets are cut into the roof, which allow the filters to suck the contaminated air out of the buildings. A vacuum pump is attached to the air inlet to facilitate the movement of air through the filtration device. The pump and the tubes used to carry the air are all constructed of plastic. If metallic air inlets were used the mercury would react with them over time, which would damage the system causing air leaks. Once the air is taken up by the filtration device, it is forced through a series of filters. These filters are made out of a combination of several items. The first layer is a fine fiberglass mesh. This mesh traps dust, and other particles that could clog up the rest of the filter. The second layer is a

combination of activated charcoal and various inorganic metals. The activated charcoal traps the mercury gas inside of the filter. The metals in the filter also play an important role; since the mercury passing through the filter reacts with the metals and binds to them. As the air moves through the filter and is passed out of the other end almost all traces of mercury become trapped in the filter. Experimental data on the effectiveness of the filters shows that an area contaminated with 1,000 ppm of mercury can be reduced to just 2 ppm. The safe level established by the EPA for airborne mercury is 5 ppm. In effect the filters work well enough to reduce the amount of airborne mercury from 200 times the safe limit down to very acceptable levels. Due to the large size of the warehouses, a total of 4 filters would be needed per building.

The filters themselves need to be replaced every 6 months for the system to remain effective. The filters are removed after that period of time and are treated. The treatment of the filters involves removing the mercury from the filters, and reapplication of the charcoal and metals. Once the treatment has been completed, the filters can be reused. This is done by heating the filters under high pressure. When the filters undergo the treatment the mercury is vaporized and collected. A picture of the machinery needed for this process is seen in figure 5 (Tambs, 1997).

Figure 5. Filter Treatment Facility.



The collected mercury can be disposed of in a hazardous waste facility, or returned to the depot for further storage. Once the air filtration system is in place, the threat of further contamination from airborne mercury is eliminated.

Soil Clean Up:

Once the stored mercury is secured, the objective of the clean up effort is shifted to cleaning the contaminated land. One method of doing this is used in Sumgait. The method employed there revolves around de-hydrolyzing the mercury, and treating the soil as toxic waste. In the Sumgait case, due to the large area of contamination, the proposed method would yield the best results. One additional factor needs to be taken into consideration when looking at the Sumgait case study; the industrial area is no longer in use. Therefore, removing the soil and treating it would not disturb any ongoing activity. Since the South Somerville Depot needs to remain active while any clean up process is conducted, stripping the soil and treating it may not be the best solution. Recent advances in biotechnology provide a more suitable solution to this problem. A new remediation technique has been developed using genetically altered plants to remove metals from the soil. This new technique called phytoremediation has been proven effective, while causing little disturbance to ongoing activities (Black, 1995).

Phytoremediation:

In the phytoremediation process, genetically engineered plants are used to remove metallic contaminants from the soil. This process involves either planting seeds, or seedlings in contaminated areas. As the plants grow, they take up metals, store the compounds, and metabolize them. Figure 6 illustrates the uptake of metals from the soil.

Figure 6. Uptake of Metals by Phytoextraction.

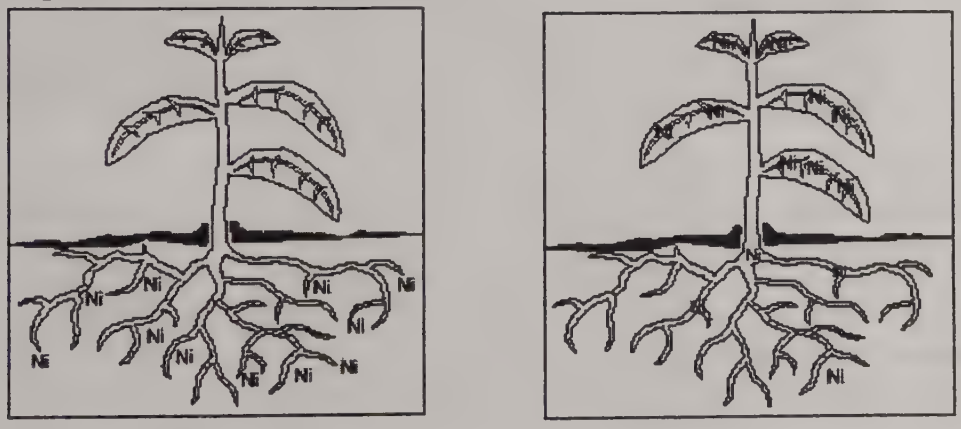
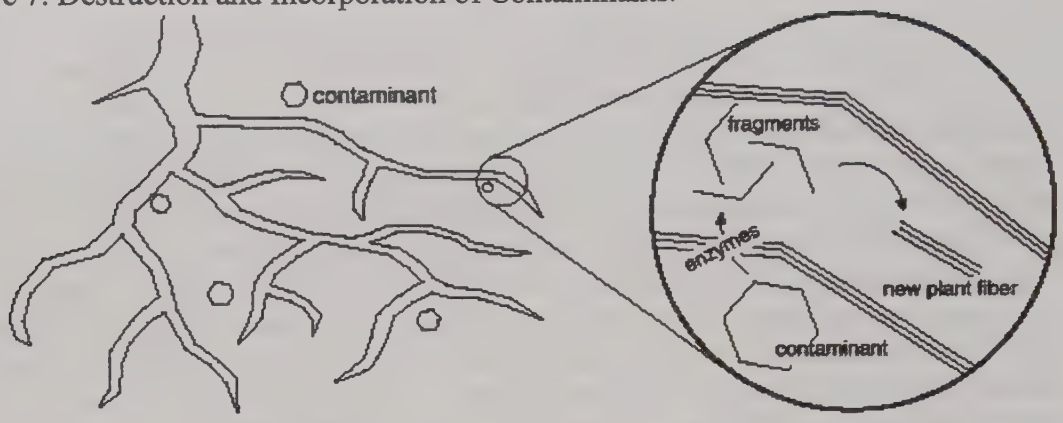

Ni
Ni
Ni

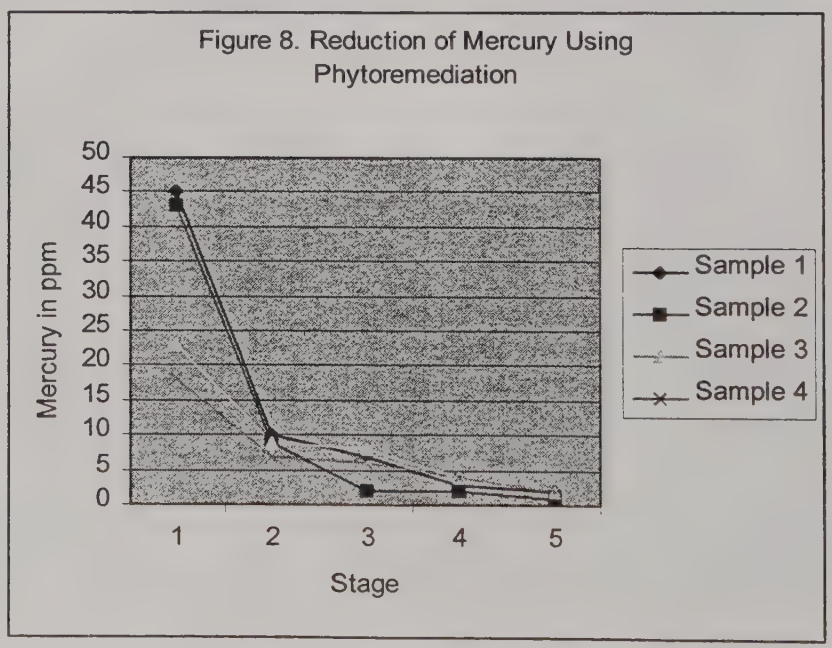
Figure 7. Destruction and Incorporation of Contaminants.



(EPA, 1998)

As the plant matures it absorbs a great quantity of the metal, and stores it in its stems and leaves. Once the plant has matured it is cut down, and treated as waste. The treated area is then once again planted with the altered plants to repeat the process. This process is repeated until the level of contamination is brought down to safe levels (EPA, 1998).

The phytoremediation process is very effective at removing contaminants. A recent study shows that an area treated with this process can reduce the amount of mercury in the soil from unacceptable levels, to levels well within safety guidelines. Results of this study are presented in Figure 8.



(Black, 1995)

The samples in the study were only treated using phytoremediation techniques, and the levels of mercury were decreased to under the 5 ppm level. Tests such as this prove the effectiveness of phytoremediation as a method of decontaminating soil (Black, 1995).

Choosing the proper plant for the site is an essential part of the process. Since Hillsborough is an area that contains a wide variety of wildlife, measures need to be taken to make sure that the plants containing mercury are not consumed. The depot itself is surrounded by a large chain-link fence. This fence is effective against keeping larger animals, such as deer, from entering the grounds and consuming the mercury laden plants. It is also important that the plants used do not produce flowers, since insects collecting pollen from those flowers would be exposed to mercury. Seeds, and fruit also need to be avoided due to possible consumption by birds or smaller animals such as mice. Therefore, in an area such as Hillsborough the only way to avoid further ecological damage is by the use of non-flowering green plants. A wide variety of genetically altered plants designed for phytoremediation meet this requirement. Figure 9 shows a picture from a research greenhouse, which houses such plants (Wagner, 1999).

Figure 9. Phytoremediation Greenhouse.

Once the plants have grown and removed the mercury from the soil, they are cut down and transported to a toxic waste facility. Since this is a government owned installation, the construction of a new waste site is not needed. The Army Corps of Engineers currently operates several such facilities, and the now toxic mercury plants can be disposed of there. When transporting the plants, ideas shown in the Sumgait example can be utilized. The plants need to be contained in covered trucks, which take predestinated routs to the waste facilities. During the Phytoremediation process, cleaning the trucks as they enter and leave the depot is an important aspect in containing the mercury inside the base. A wash area needs to be established for this purpose, with a system to collect run off water for treatment (Thompson, 2000).

Once the mercury is secured in the first stage, and the soil is treated in the second stage a system is needed to evaluate the effectiveness of the project. This would be the final aspect of the clean up.

Retesting:

After the air and soil in the base are treated, constant monitoring becomes a priority. The monitoring serves two purposes; the first is to judge the effectiveness of the clean up, and the second is to make sure that no new contamination occurs. EPA testing of the ground water, soil, and air should be conducted monthly as the phytoremediation process occurs. The monthly testing would show the decrease in mercury levels as the project progresses. Once the tests show that the mercury content is at a safe level, the remediation process could be terminated. After the termination of phytoremediation, biannual testing of the soil needs to be conducted to determine if any new contamination occurs. If new sources of contamination are found, they need to be addressed quickly. However if testing is done on a regular bases, any new source of contamination would be discovered early, and therefore cleaning up the problem would not be a major burden. Air testing inside the warehouses also must be conducted. These tests will determine the effectiveness of the newly added air filtration system (EPA, 1992).

Budget

The cost of this entire process would be relatively small. The phytoremediation of soil is one of the cheapest ways to treat contaminated land. Compared to organic acid treatments, or stripping the land and treating it, the cost savings of using phytoremediation are 42% and 68% respectively.

Costs:

1. New air filtration system (including labor for installation):	$66,104
2. Replacement and treatment of filters:	$11,000
3. Phytoremediation of contaminated ground:	$2,148,000
4. Proper disposal of plants:	$4,300
5. Wash down area for trucks:	$8,200
6. Treatment of contaminated water from wash area:	$3,100
7. EPA Testing	$23,000
Total:	**$2,263,704**

Since this is a government installation labor costs are not factored in since military personnel are involved. The upkeep of the facility would be conducted by military personnel already stationed there, incurring no additional cost.

Discussion

The South Somerville Depot is a heavily contaminated military installation located near residential areas. This contamination occurred due to lax safety measures in the past, which have been corrected. However as a result of these lax safety measures the town of Hillsborough is faced with a serious mercury problem. If not addressed immediately, this problem has the potential to harm thousands of innocent people in the near future.

Preliminary testing of the site has already been completed, and more tests to pinpoint the exact areas and amounts of mercury contamination are planned to begin in 6 months. Once these tests are completed, a system should be established to eliminate the problem.

The first step in controlling the problem is to make sure that no more mercury is released. Polymer floors, new barrels, and revised safety measures have already been implemented for this purpose. However, mercury contamination can also spread through the air. An air filtration system is needed to fully secure the stored mercury. Vehicles coming into and out of the installation need to be washed to remove any contaminants. Once these measures are in place, the largest amount of mercury on earth will be safely stored.

The next issue that needs to be addressed is cleaning up the contaminated soil. Phytoremediation offers a cost effective, and very reliable means by which to accomplish this goal. Genetically altered plants are grown on the contaminated soil, which remove the mercury from the earth as they grow. Once the plants are disposed of properly, the mercury problem will be eliminated.

Testing of the site is a vital part of the process. Testing is needed to determine when phytoremediation of the site should be suspended. It also gages the effectiveness of the remediation process.

Once the steps are completed, the 3 million residents within a 25-mile radius of the site will no longer be threatened with mercury problems. The DNSC has stated that its primary objective is the safety of its facilities, employees, and communities. All that is being asked in the case of the South Somerville Depot is that they live up to their promise.

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Proposal for a Senior Exercise Program

This writer does a great job working within an interrelated triangle of ideas: seniors become depressed when the community treats them as disconnected, isolated beings—exercise is one of the best treatments for depression in the elderly—the community spends none of its recreation budget on the senior citizens. A community's responsibility for the well-being of its citizens is the paradigm guiding the argument.

17 Northfield Dr.
Mooncolonie, NJ 98765
April 30, 2001

Denise Bonanno, Chairperson
Parks and Recreation Services of Nutley
751 Park Avenue
Nutley, NJ 07110

Dear Ms. Bonanno:

I would like to offer my full proposal that I have formulated in concern for the senior citizens who reside in the New Street Retirement Complex. My intent is to establish weekly exercise programs in an effort to improve the mental health of seniors living in this retirement home who are currently suffering from various degrees of Major Depressive Disorder (MDD). Major depressive disorder is usually an episodic disease, with recurrent incidence in at least 50% of the patients seeking treatment in the form of antidepressant medication for major depression. Many seniors living an isolated lifestyle at this retirement home suffer from the symptoms of MDD and are in need of an exercise therapy to alleviate the ailments of this disorder.

I acknowledge the strong efforts made by your staff in organizing numerous sport leagues (i.e. basketball, indoor soccer, floor hockey and softball clinics) offered to all Nutley school children and young adults, and I would like to expand your recreational services to the seniors residing in this retirement complex. I have extensively researched the beneficial effects moderate exercise has on elderly, and found in many studies that exercise proves to be just as effective as antidepressants in relieving symptoms of MDD. In a study conducted in a similar living environment, depressed seniors tended to report stress-coping strategies that were more avoidance-oriented, whereas happier seniors reported that they were more goal-oriented and accepted challenges and change with active responses, a positive outlook, and physical exercise (Sharpley and Yardley, 1999).

In addition, I plan to educate all the seniors living in the New Street Retirement Complex of the benefits of regular exercise in diminishing the symptoms of major depressive disorder. Regular exercise offered by the Parks and Recreation department will, depending on the degree of MDD, increase the elderly people's sense of control, overall health, well-being, life satisfaction, and diminish thoughts of suicide by elevating depressed mood. I hope to promote senior exercise programs that are closely supervised

by a skilled and qualified staff, provided social support, incentives, and motivational tips that will lead to the success of an effective exercise facility. Making the Parks and Recreation building accessible to the elderly living at this retirement home, developing personal exercise programs, offering various exercise equipment, and maintaining sufficient attendance through goal setting strategies and motivational tips will make a significant improvement of the overall mental health of the active senior. The Parks and Recreation building with its adequate size, potential occupancy capacity, transportation services, and proximity to the New Street Retirement Complex is ample for the demands of this proposal. I believe that this facility can offer some solutions and help resolve an ongoing physical/ psychological problem for the seniors residing in this retirement home.

I hope you find good intent in my proposal. Thank you very much for your time and consideration. I may be reached at the above address or (xxx) xxx-xxxx if you have any further questions or concerns and look forward to hearing from you.

Sincerely,

Catalin Phillips

Establishing Exercise Programs for the Elderly Citizens of the New Street Retirement Complex: A feasible therapy for Major Depressive Disorder

Submitted by: Catalin Phillips

Submitted to: Denise Bonanno, Chairperson
Parks and Recreation Services of Nutley
751 Park Avenue
Nutley, NJ 07110

Submitted on: April 30, 2001

Final Proposal for Scientific and Technical Writing
If found please return to:
Barbara Hamilton
English Department
Loree 036 (Cook/Douglass)

Abstract

This proposal focuses on the seniors who live at the New Street Retirement Complex suffering from symptoms of Major Depressive Disorder. The intent of the proposal is to implement weekly exercise programs to all the seniors living at the retirement home as an alternative psychological therapy for major depressive disorder. Through evidence published in research journals, regular exercise about 3 times per week in 45 minute duration has proven to be just as if not more effective than the traditional antidepressant medication for relieving symptoms of Major Depressive Disorder.

The goal of this proposal would be to utilize the Parks and Recreation building of Nutley, as an exercise facility for seniors in attempt to improve their overall mental health by elevating depressed mood, boosting self confidence, controlling anxiety, thus initiating increased levels of well-being and life satisfaction. The professional staff working in the Parks and Recreation facility would emphasize the importance of long and short term goal setting and maintain peak attendance by establishing motivational strategies contoured to the needs of each senior participant. In addition, the professional staff would continuously encourage each participant by educating them on the gradual psychological and physical benefits of moderate exercise by implementing weekly charting of each senior's advancement on the weekly progress sheet. The ultimate objective of this proposal is to improve the lifestyles of the seniors by surpassing their current physical and psychological status.

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Introduction

Overview of Major Depressive Disorder and its Affliction on the Elderly

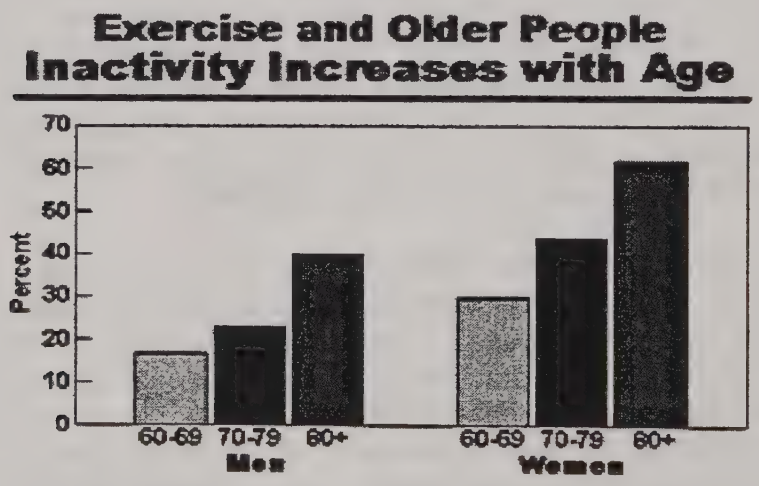
The elderly population is consistently increasing each year. A large percentage of seniors experience depression in their daily lives and it has considerably changed their personal outlook towards life. Elderly patients with first onset after they are 60 years old appear to be at risk for developing chronic major depressive disorder. Older Americans are living longer, but a large number find their health threatened by chronic psychological maladies such as Major Depressive Disorder that will gradually diminish their overall quality of life. Major Depressive Disorder (MDD) is a psychological disease that effects an estimated 15% of the general public over the age of 65, with the frequency being twice as high in woman as in men. MDD is a psychological syndrome with symptoms that include depressed mood and loss of intent or pleasure combined with at least four of the following ailments: sleep disturbances, weight loss, changes in appetite, psychomotor agitation, feelings of worthlessness, excessive guilt, impaired cognition or concentration, and recurrent thoughts of death. All of these symptoms are based on the Diagnostic and Statistical Manual of Mental Disorders 4th edition. In similar retirement homes, comparable to the New Street Retirement Complex, it has been found that the incidence of major or minor degrees of depression effects an estimated 15-25% of the seniors residing there. Research has proven that 25% of suicides reported associated with the elderly, occur especially in males over the age of 80. Various degrees of MDD has also been established as the 3rd cause of disability in the elderly.

Many senior citizens resort to taking medications such as anti-depressants in the treatment of MDD. While antidepressant medication can be very effective, biological treatments do not resolve all problems. Unfortunately, it has been proven that 30-35% of depressed patients, in general, do not respond to antidepressant medications and for others the medication can cause unwanted side effects. Still, on many occasions antidepressant medication treatments have proven effective, but in many situations share the attribution of psychological improvement with the presence of regular exercise. Unfortunately only 1 in 4 older adults exercise on a regular basis (National Institute on Aging, 1997).

Furthering the problem in the elderly, symptoms of MDD are often incorrectly attributed to the aging process and seen as ongoing ailments of getting older. While the elderly make greater use of medical services, physicians are often uncomfortable talking about depression, or overlook it in favor of addressing medical conditions. The elderly patients may also more readily report body related symptoms rather than depressed mood, again complicating accurate diagnosis of depression. With lower functional expectations, health care professionals may not readily appreciate the degree of impairment MDD has on the elderly, and again misdiagnose psychological disorders by attributing them to physical ones (McAleer, 2001).

Because older adults tend to develop chronic maladies, exercising does not seem to be a priority. Seniors tend to decrease their level of physical activity as they age, revealing a trend that appeared to increase the likelihood of becoming depressed regardless of socioeconomic factors and health status (Exercise, 2000). One possible reason for this is that many older people think they are too old or too frail to exercise. Feelings of depression, fatigue, physical discomfort, and isolation are other de-motivating factors when it comes to aerobic activity. Keeping peak attendance at the Parks and Recreation Building will be one of the largest challenges for the professional staff. The elderly are also more likely to be motivated to exercise if their physician recommends it. A study conducted by researchers at the University of California at San Francisco found that less than 50% of older adults ever receive a physician's suggestion to exercise (Wetle, 1999). **This suggests that community officials along with physicians should be encouraging elders to exercise if we expect to see physical activity rates increase in the future rather than decrease with age, as seen below.**

Figure 1



(National Institute on Aging, 1997)

Unfortunately, many seniors residing at retirement homes live in isolation. Family and friends may not be in close proximity, allowing support for the needs of the senior resident. The senior has to deal with living in isolation and losing strong ties to the outside world, leading to a sedentary lifestyle, which can adversely induce debilitating forms of depression. At the New Street Retirement Complex physical activity is encouraged in effort to improve health but is suggestive of individual exercise done on their own time in their private living space or elsewhere. No standardized exercise programs exist for the 245 elderly living at the retirement home. Many of the residents living at the retirement home do not drive an automobile, so it is imperative to supply an adequate transportation service to and from the Parks and Recreation Building 2.3 miles away.

Literature Review

Exercise Has Proven Effective in Treating Major Depressive Disorder

Declines in various physical abilities are a natural part of aging. These declines are often accompanied by various degrees of depression and lowered self-esteem among the elderly. Older men and women who reduce their level of physical activity, over time, will become more likely to suffer from depression than individuals who maintained or increase their level of activity. Sedentary living is one of many possible causes for negative emotional states, moods, and poor self-image. Fortunately many researchers agree that physical activity, in the form of moderate weekly exercise programs, can play a significant role in reversing many of the symptoms associated with Major Depressive Disorder.

In several studies, it has been proven that active seniors are less susceptible to depression. Taking a brisk walk regularly can help lower the risk of health problems like heart disease or depression. Climbing stairs, calisthenics, or housework can increase strength, stamina, and self-confidence. Weight lifting or strength training is a good way to stop muscle loss and slow down bone loss. Daily activities will become easier as one feels better. To illustrate, a group of healthy, older adults said they felt less anxious or stressful after exercising for one year (National Institute on Aging, 1997).

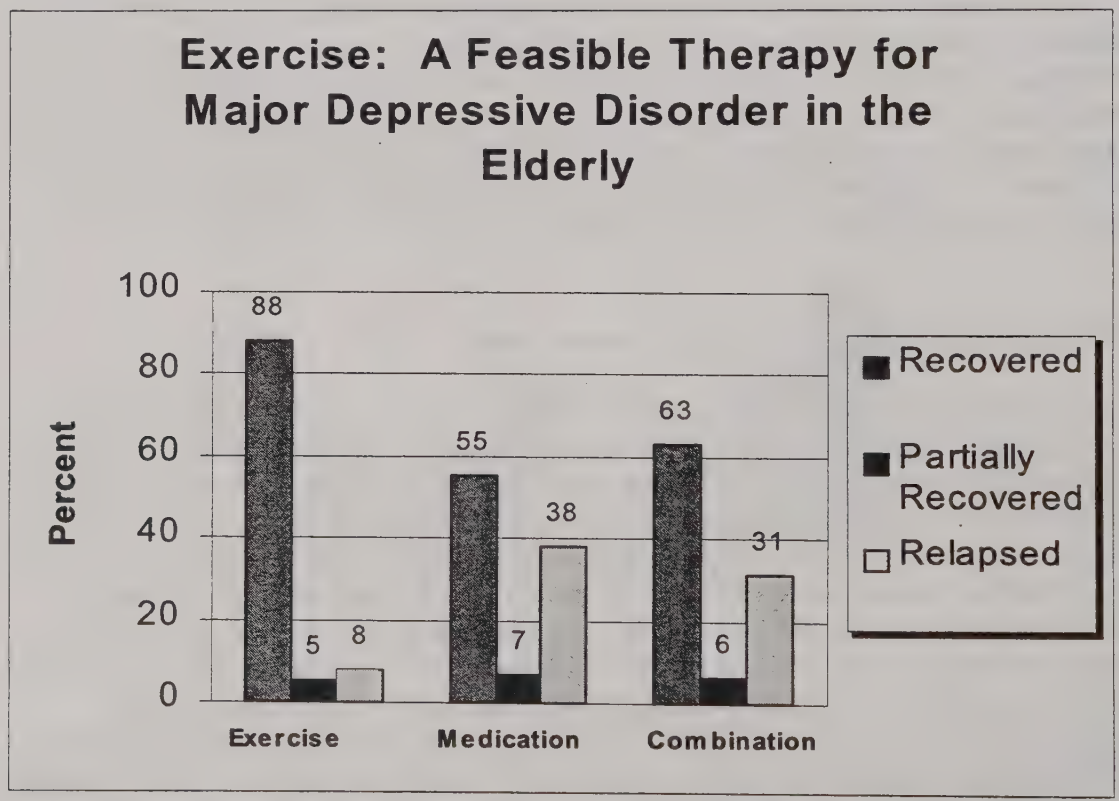
Duke University Medical Center Experimental Study

More specifically, in a recent Duke University study, published in the October 2000 issue of Psychosomatic Medicine, James Blumenthal (head of research on this study) and co-working researchers found similar psychological benefits associated with regular exercise programs for the elderly. The study tracked the psychological well-being of 156 adult volunteers who had been diagnosed with a Major Depressive Disorder (MDD) before, during, and after they underwent a four-month treatment program. The participants were equally divided into three groups: one group was treated using an aerobic training program which entailed a 45 minute, low-to-moderate intensity workout, three times per week. The aerobic exercise programs included cycling or a brisk walk/jog at 70 to 85 percent of their maximum heart rate. Another group in this study used antidepressant therapy, a commonly prescribed medication called Zoloft, to combat the psychological ailments of MDD, and a third group was formed using a combination of exercise and drug therapy. By the end of the four months, all groups exhibited similar, significant improvements in their psychological well-being, many to the point where they no longer met the diagnostic criteria for their MDD (based on the Diagnostic and Statistical Manual of Mental Disorders, 4th edition).

The most relevant result of the study is that six months after the treatment programs individuals in the exercise group were far less likely to relapse than the individuals in the antidepressant medication group and the combination group. The

exercise group was as effective as medication after 16 weeks of treatment. All three groups exhibited a significant decline in depressive symptoms. Although researchers do not know the exact physiological reason why exercise is so effective, this study proves that exercise should be considered as a credible form of treatment for the elderly suffering from MDD. As mentioned previously in the introduction, 30 to 35 percent of depressed patients in general do not respond to medications and for others the medication can cause unwanted side effects. Furthering the notion that various levels of exercise should be highly suggested to seniors suffering from MDD. Exercisers showed significantly lower rates of depression (30%) than patients in the antidepressant group (52%) or the combination group (55%) (Active, 2001). Overall patients appear to achieve significant clinical improvements in their psychological and physical well being with exercise training as seen in Figure 2.

Figure 2



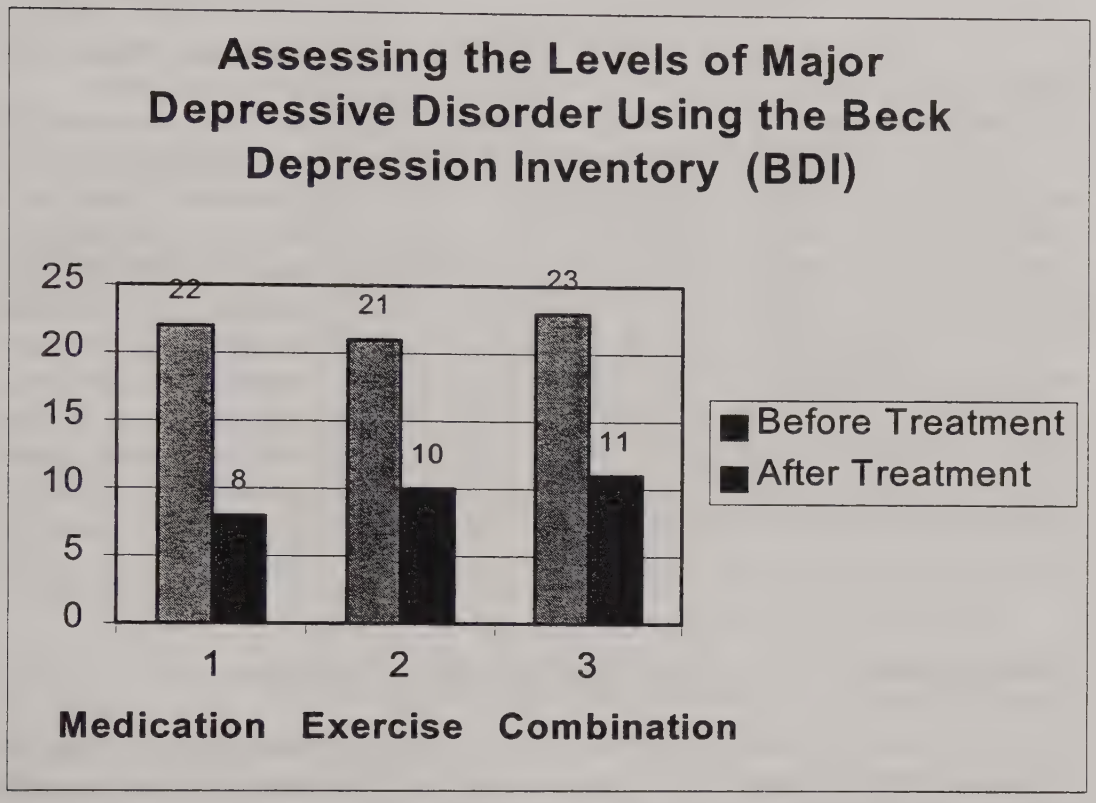
(Blumenthal, J. A., Herman, S. *Geriatrics*, December 2000)

- About 2/3 of the individuals in the exercise and combination groups reported a continued exercise regiment on their own, after the study.

In addition to the experimental statistics gathered, the 156 elderly volunteers had their degree of Major Depressive Disorder measured on the Beck Depression Inventory (BDI). The BDI is an accurate psychological evaluation based on a 21 item self report

questionnaire consisting of symptoms and attitudes relating to depression, including items such as self-dislike, suicidal ideas, insomnia, and sadness. The items described are summed on a scale of 0 to 63, the higher the score the more severe the symptoms of MDD. The BDI has been shown to be a valid and reliable measure of depression severity as seen in Figure 3.

Figure 3



(Blumenthal, J.A, Herman, S., *Geriatrics*, December 2000)

The results and conclusion of this extensive study depict and support the notion that a group exercise program of aerobic activity is an effective treatment for depression in older patients. Depression scores on both the Beck Depression Inventory and experimental statistics indicate that clinical symptoms of MDD were significantly reduced in the exercise group. Exercise proves to be just as if not a better form of treatment and has proven this result by showing significantly lower rates of depression (approximately 30%) in comparison to the participants in the antidepressant group and the participants in the combination group.

In final note, James Blumenthal (head of research on this study), attributes exercise by mentioning in the study that patients who do exercise on a regular basis may feel a greater sense of mastery over their condition and gain a greater sense of accomplishment (Blumenthal, J, 1999). Taking an antidepressant pill is very passive, rather than the patient having full control over his or her own symptoms, the mindset and

ailments of depression in the patient are controlled by the medication. Thus, the seniors participating in daily activity feel more self-confident and have better self-esteem because they are able to do it themselves and note their psychological improvement to their ability to exercise.

University of Illinois Study

In a recent University of Illinois study it was found that elderly women, who participated in regular exercise and physical activity, experienced long-term psychological benefits. This study of 174 overweight and relatively unfit women (60 to 75 years old) were divided into two exercise groups required to participate in three stretching or three walking sessions per week for a six month duration. Based on the results of pre and post program physical exams and psychological questionnaires; the researchers conclude that regular exercise had positive effects on the self-esteem and body image of the elderly women. They also found that continuance of these effects depended on the seniors' adherence to regular exercise and on the type of exercise in which they engaged (Active, 2001). After the study was complete six months later, 51 percent of the women in the walking group and 75 percent of the women in the stretching group had maintained the levels of activity introduced in this study. Results also depict that for the majority of the women studied, psychological benefits, including increased levels of self-esteem and body image, were still evident in the participants who continued regular activity on their own.

Further Evidence: Exercise Can Reduce Depression in the Elderly

In a study published in a recent issue of *Preventive Medicine*, Paivi Lampinen and colleagues with the University of Jyvaskyla in Finland, compared exercise intensity and depressive symptoms in 663 people aged 65 years or older. The researchers of this study interviewed all the participants at the beginning of the study and then again 8 years later. Physical activity of the participants in this study was divided into three categories: necessary chores only, regular walking and strenuous physical exercise. Throughout the study, general results show that the senior volunteers tended to decrease their level of physical activity as they aged. This trend appeared to increase the likelihood of becoming depressed, regardless of socioeconomic factors and health status. The study showed only 30 percent of those who engaged in strenuous physical activity at the onset, maintained their personal level of activity. As a result, these people reported fewer symptoms by the end of the eight-year study. On the contrary, participants who became less active over time were more depressed (Lampinen, 2000).

Kinds of Activities that Improve Mental and Physical Health

There are four types of exercises that are important for older adults. I have already stressed the psychological benefits obtained from regular exercise, and find it

relevant to discuss the physical health benefits older adults gain. These physical activities include endurance exercises, strength exercises, balance exercises, and flexibility exercises.

Table 1: Classification of Exercises

• Endurance exercises	These exercises increase breathing and heart rate. They improve the overall health of the heart, lungs, and circulatory system. Having more endurance not only keeps the senior healthier, but can also increase their level of stamina to do daily tasks needed to live and do things on their own. Endurance exercises may also delay the onset or prevent many disease associated with the elderly.
• Strength exercises	These exercises focus on building muscle, but play a larger role than just making the senior stronger. Strength exercises can give the senior the muscle force required to do tasks on their own for daily living. Relatively small increases in muscle strength can make a big difference in the ability (especially frail individuals). In addition, strength exercises can prevent the onset of osteoporosis and increase the seniors' metabolism, helping to keep weight and blood sugar in check.
• Balance exercises	These exercises prevents falls, in older adults is the major cause of broken hips and other injuries that often lead to disability and loss of independence. Some of these exercises build leg muscles while others improve the seniors' balance by requiring them to stand on one leg as a brief, simple activity.
• Flexibility exercises	These exercises are commonly known as stretching exercises. They help keep the body limber by stretching the muscles and play a part in preventing falls. Physical therapists and other health care professionals recommend certain stretch exercises to help their patients recover form injuries and to prevent injures from happening in the first place.

(National Institute on Aging, 1997)

Literature Review Conclusion

Just about any senior can do some type of physical activity to improve his or her overall health. Even seniors with chronic disease including MMD can and should exercise on a weekly basis, as recommended by several researcher and experts on the issue. It has been proven that most elderly do not receive enough aerobic exercise and there are numerous facts attributing to the benefits. For instance, regular exercise can help people feel better and enjoy life more, even those who think thy are too old or too out of shape. In fact, staying physically active is key to good health well into later years.

Plan of Action

Main Objective

My proposal will establish the Parks and Recreation Building as the center for aerobic exercise for the elderly living at the New Street Retirement Complex. I intend to have this first year plan, specifically the 245 seniors residing at the retirement home, as the first of several possible locations throughout Nutley in an effort to accommodate all seniors residing in town.

The use of the Parks and Recreation Building will fulfill several main objectives. These objectives include increasing community support in providing means of safe physical activity, having the professional staff develop motivational strategies that include long term goals, weekly charting of the participants mental and physical progress, and provide proper education for the participants of the health effects of moderate physical activity.

The Parks and Recreation is an ideal location to supply the elderly living at this retirement home with safe effective means of physical activity. All potential members of the exercise facility will be provided with adequate bus transportation provided by the Parks and Recreation Building. The Parks and Recreation department owns 9 buses that will be placed on a regular arrival and departure schedule at both the retirement home and recreation center.

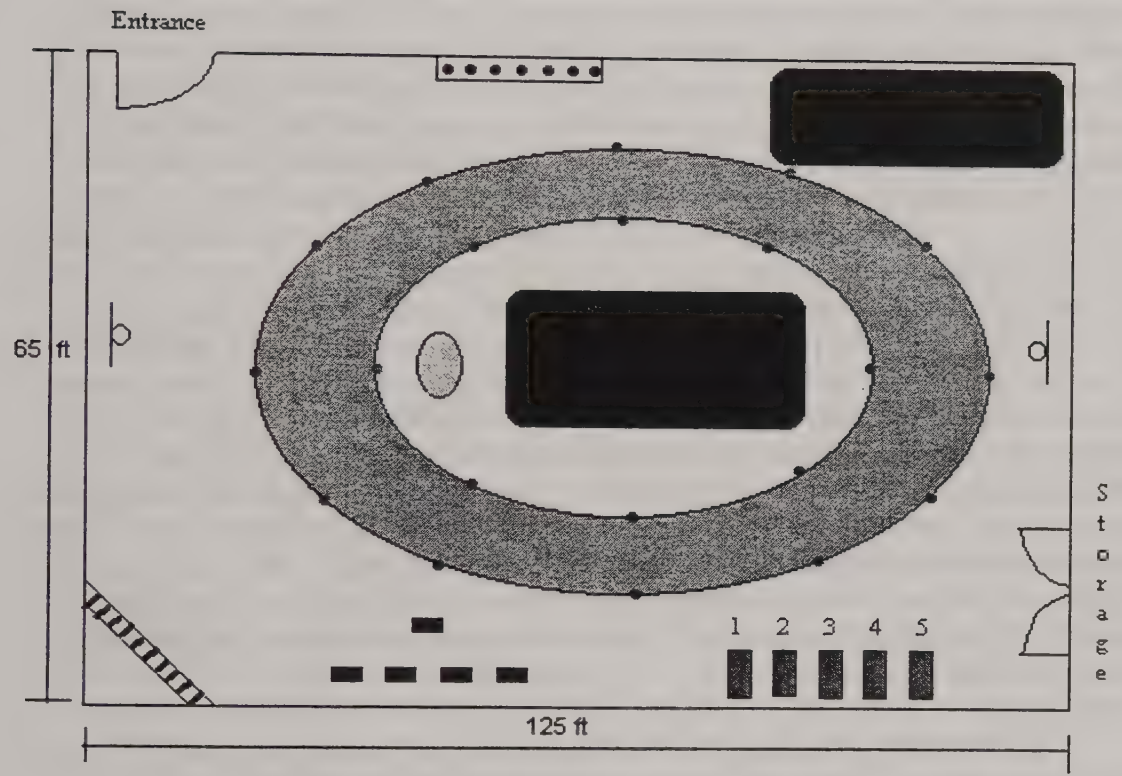
Seniors interested can benefit from a maximum of 3 workout sessions per week. Each session will have a duration of 45 minutes (maximum), as recommended from various studies. This exercise facility will be equipped with many amenities such as an oval track for walking (wrist/ankle weights are optional), exercise bicycles, step aerobics, and low to moderate resistance stretch bands. The trained professional staff will be available at all times for assistance.

Table 2: Parks and Recreation Facility Schedule

Monday through Friday

1st Session	**10:00am – 10:45am**
2nd Session	**11:00am – 11:45am**
3rd Session	**1:00pm – 1:45pm**
4th Session	**2:00pm – 2:45pm**

Figure 4: The Floor Plan



The Floor Plan for the Parks and Recreation Building

Low grade steppers

Exercise bicycles

Stretching Mats

Oval Track

Ankle/Wrist strap weights

Low to Moderate resistance bands

Motivational Strategies

Because older adults tend to develop chronic maladies, exercise does not seem to be a priority. Constant feelings of depressed mood, physical discomfort, and isolation from living in a retirement home are discouraging factors when it comes to regular aerobic exercise. Thus, motivational techniques will aid in the maintenance of a healthy,

active lifestyle. In several studies it has been found that if an activity makes a person feel good, then he or she will be motivated to continue. On the other hand, if the personal experience at the facility is not a positive one, then the chances of returning are slimmed. Therefore, it is imperative that encouraging features of the facility are created to the molds of interests, abilities and goals of the participants involved.

In order to maintain peak attendance at the Parks and Recreation facility, it is essential for the professional staff to guide the seniors with good self-discipline procedures. Some formative tips by the U.S Surgeon General's report on motivation include exercising with a partner, establishing specific individual goals and using audio devices, such as a recorded book or music that help while performing endurance activities. Others say that, while physical activity makes them feel better, a little extra motivation helps them get going. In addition the professional staff, working at this exercise facility, should encourage self-assigned homework of physical activities, time management (regarding exercise sessions as appointments by marking them on a calendar), and have the participants focus on the psychological benefits during the times when physical progress is not significant. Trained professionals, hired by the Parks and Recreation department, should be aware of each senior's medical and psychological status. They should acknowledge each individuals intent, long term goals, physical abilities, and personal interests. Strategies for increasing physical activity among older patients include: (1) increased physician counseling and public education about the health effects of moderate physical activity, (2) increased senior and community center programs that are supervised and provide social support and other incentives for exercise, and (3) increased community availability and accessibility of safe physical activity within recreational facilities (DiPietro and Dziura, 2000). Encouragement to exercise through community support will not only significantly decrease the isolation time the senior spends in their personal living quarters, but also advocates social interaction, friendship, and group activity.

All of the seniors residing at the retirement home will receive pertinent information explained in a series of group orientations at the retirement home prior to starting their personal exercise program. The members will be educated on the psychological benefits aerobic exercise, all the equipment available, and the types of physical activities offered at the facility such as endurance, strength, balance, and flexibility training.

Weekly Progress Sheet

Each hired aid at the facility will encourage daily charting of the participant's progress after the individual has chosen a realistic goal, and learned to do the exercise correctly and safely. Screening for depression in the elderly can be quick and productive, beginning with the awareness of the need to screen. Questions, found on a weekly progress sheet, can successively target some symptoms of depression. Each weekly progress sheet will consist of simple questions including self-assessment (How do you feel today?), exercise equipment utilized (What exercise, stretching techniques or

equipment was used today?), duration of daily workout, and fitness goals for the week. At the bottom of the weekly progress sheet will be a space where participants can suggest any changes in the exercise program or express any general concerns. Recording the participant's scores and watching them improve can be an excellent motivator to exercise. Questionnaires revealed that regular exercise increased self-esteem and improved body image of the active senior. In addition, the participant is more likely to stick with an exercise program if he or she is properly set up to succeed from the start. Studies have proven if the participant sticks with the exercise program for more than a month, it's a good sign that they will be on their way to making it a permanent habit. On the contrary, many older adults find maintaining motivation to keep exercising and doing physical activities isn't a problem. They say that regular physical activity makes them feel so much better that it would be hard to stop (Active 2001). The potential member's physician must medically clear them before engaging in the activities available at this facility. It must be emphasized that this facility is not a physical therapy center, but serves as a building for safe physical activity. The staff will collect written documentation in order to set up a suitable exercise regiment.

The Professional Staff

The full time staff hired at the Parks and Recreation facility will have received a Bachelor of Science degree in Exercise Science or equivalent. Each full time employee will need to be certified by the American College of Sports Medicine (ACSM). ACSM certified professionals are well qualified to help the senior develop a safe and effective exercise plan. The ACSM is an excellent resource that trains and certifies people to work with older adults. The ACSM is made up of health professionals and scientists with a common interest of fitness. Some of its members are among the nation's leading experts on the topic of exercise and physical activity. Finally, each full time staff member will need CPR and first aid certification. Also, it is suggested that the trained staff take suggestions by the members and modify the facility to meet the needs of all the participants. The part time staff will be local college students doing an internship. The minimum requirement of each intern will be that they are currently studying Exercise Science or a related major with at least 40 credits towards that major. The intern will also be CPR and first aid certified.

Project Budget

Full time Staff - $33,500
(Per year)

Part time Staff -$8,000 (x 2)
(Interns hired for 15 – 20 hrs/week at $10/hour)

Exercise Equipment

Padded mats - - - - - - - - - - - - - - - - - - -	$ 0	
Wrist/Ankle Strap Weights - - - - - - -	$18/pair	(x 25)
Exercise bicycles - - - - - - - - - - - - - - -	$400	(x 5)
Steppers -	$80	(x 5)
Resistance Stretch Bands - - - - - - - - -	$50	(x 15)

Transportation - $ 0
(Provided by the bus system of the Parks and Recreation Building)

First Year Total $53,100

Discussion

To improve the mental health of seniors, it is apparent that action needs to be taken toward the establishment of exercise programs using the Parks and Recreation Building in Nutley. It is my hope that this facility will be offered to the residents of the New Street Retirement Complex by the township of Nutley and eventually trigger the expansion of similar exercise facilities in accommodation for the additional elderly population in town. In order to provide for the needs of each senior, this particular center should be equipped with the proper staff and equipment needed to accompany the various activities offered. Although the majority of the seniors' residing at the retirement home can utilize the facility (if reaching the mandatory physical requirements), one of the main intentions of such a proposal is to focus particularly on those with psychological disorders, especially MDD.

The many statistics prove that Major Depressive Disorder is a serious debilitating mental disorder affecting up to 1/3 of the seniors living in the New Street Retirement Complex. The proposal explores the problem further by identifying and depicting the many symptoms and problems affiliated with this psychological disorder. Age related decrease in the intensity of physical exercise increases the risk of depressive symptoms among older adults, thus a solution calling for effective measures in maintaining and supporting an adequate level of physical exercise predominantly through community assistance is key. The overall interest of the program would be to enhance the seniors' quality of life through daily activities provided by such an exercise facility.

The hired professional staff would not only be responsible for maintenance of a successful program but would also implement various strategies for maintaining motivation, intent, goal setting, and progressive steps made by each senior participant. Just about any senior can do some type of physical activity to improve his or her overall health and sense of well being. There are numerous facts attributing to the psychological benefits of exercise. Exercise on a regular weekly schedule can help the elderly feel better and enjoy life more, even those who think they are too old or out of shape. In addition, a compilation of the weekly progress sheets will be prepared in a concise report and submitted to the Parks and Recreation department every three months. This report will function as an evaluating tool of the success and overall direction of the program.

In conclusion, I hope you find validity in my proposal dealing with the ongoing problem of MDD, involving the senior citizens living in Nutley. As a service to the elderly living at the New Street Retirement Complex, I feel it necessary to provide a nearby recreational facility supplied with the essential equipment required to run a successful exercise program. It seems logical that such a proposal would help to offer a healthy alternative in dealing with MDD that does not require medication in the form of antidepressants. Since the Township of Nutley has a facility that can offer such a program, no significant changes or drastic spending would be necessary because the basis for such a recreation center is intact.

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Proposal for Sex Education Class

This project came about as a result of the writer knowing a young girl whose life was drastically affected by a lack of knowledge about how to handle sexual situations. Despite knowing nothing about the school system and nothing about the topic initially, the writer did the research and came up with a convincing mix of national and local statistics. Given the genesis of this idea, the writer could have relied on pathos and outrage. Instead, she crafts a convincing proposal based on the strength of the research, the validity of the paradigm, and the logic of the argument.

980 Morganville Terrace
Glyn Ellyn, NY 10399

December 11, 2000

Chairwoman Eleanor Conforti
Community School Board 31 District Office
715 Ocean Terrace
Staten Island, NY 10301

Dear Chairwoman Conforti,

The enclosed proposal deals with updating the sexual education component of the health education curriculum currently taught in Tottenville High School. Since Tottenville High School is under the jurisdiction of Community School Board 31, any change in its curriculum, especially in a controversial topic such as sexual education, warrants your support and approval.

Tottenville students have lower rates of sexual activity than the national average, but also have lower rates of condom use and birth control use. These students lack either the knowledge or the incentive to use the various birth control options that are available to them. The current program is a traditional curriculum that has been ineffective in reducing the rates of risk behaviors among Tottenville's students. I wish to implement the "Reducing the Risk" program, which has been approved by the Centers for Disease Control and Prevention as a Program that Works. It has been proven effective in reducing risk behaviors in demographically diverse populations. The program demands that students play an active role in the class rather than learn in a traditional lecture style manner. This active role makes the program more effective and promotes a healthier student population, which is the primary goal of any health education curriculum.

After reading my proposal, I hope you realize the importance of implementing the Reducing the Risk program into Tottenville High School's health education program. Thank you very much for your time and consideration. If you have any questions regarding this proposal please do not hesitate to contact me via email at xxxx@aol.com, or by phone at (xxx) xxx-xxxx.

Sincerely,

Natalia Duncan

UPDATING SEXUAL EDUCATION IN TOTTENVILLE HIGH SCHOOL

Submitted By: Natalia Duncan
Submitted On: December 11, 2000

Submitted To: Chairwoman Eleanor Conforti
Community School Board 31
Community School District Office
715 Ocean Terrace
Staten Island, NY 10301

Final Proposal for Scientific and Technical Writing
If found, please return to:
Barbara Hamilton
English Department
Loree 036 (Cook/Douglass Campus)

ABSTRACT

America's teenagers engage in the most risky activities of any age group across the nation. Dangerous sexual practices are among these risk behaviors. Despite progress made over the past decade, rates of teen risk behaviors are still high and need to be addressed. One of the best ways to teach young adults to maintain healthy life behaviors is through school health programs. In Staten Island, a borough of New York City, high school students who attend Tottenville, a public high school, have poor rates of condom use and birth control use. They are also engaging in sexual activity at an early age, with 50% of students by having engaged in sexual intercourse by age 17. The current sexual education program at Tottenville is a traditional lecture styled curriculum that has not been producing the desired results of guiding teenagers toward making healthier lifestyle decisions. This plan proposes that a new program, one promoted by the Center for Disease Control and Prevention, be implemented in Tottenville. By providing students with an active role in the classroom, the program has produced very positive results in situations that are demographically similar to Tottenville's student body. This proposal has the potential to produce great results in Tottenville, bringing with it a healthier young adult population, which is the goal of any comprehensive health program.

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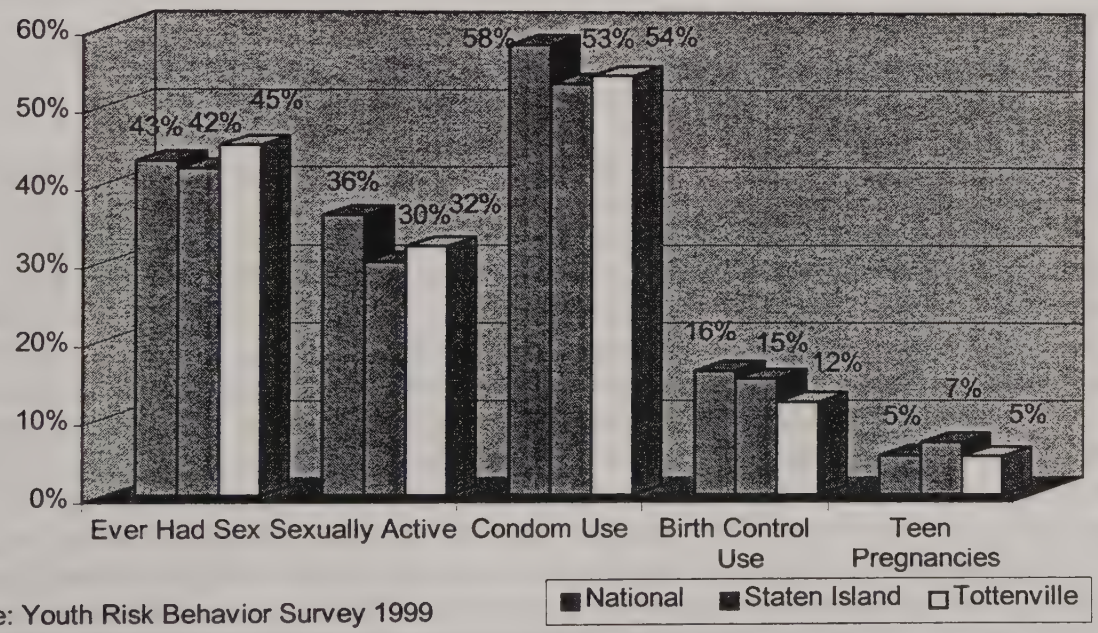
INTRODUCTION

Youth Risk Behaviors: An Area of Concern

Every year, approximately three million cases of sexually transmitted diseases occur among teenagers as well as roughly one million teenage pregnancies (cdc.gov, 2000). Although risky behaviors among teenagers have been on the decline for more than a decade, progress has been slow and teenagers are still engaging in behaviors that put them at risk for chronic diseases as adults. Nationwide, 8% of students will have engaged in sexual intercourse by age 13, and 25% will have had sex by the time they are 15. Fully 50% will have had sex by the age of 17, and at this age at least one third of students will be sexually active[1] (Chamberlain 2000). According to the 1999 Youth Risk Behavior Surveillance System (YRBSS) 43% of students reported having had sex in their lifetime. This figure, though still high, is down 4% since 1991. This represents one area in which progress has been made to prevent risk behaviors by teens (cdc.gov, 2000). Other improvements include increased use of condoms and decreased incidence of multiple sex partners by teens.

Figure 1: Incidence of Risk Behavior



Source: Youth Risk Behavior Survey 1999

Staten Island's rate of sexual intercourse by students is comparable to the nation's rate at 42%. Tottenville's students, when surveyed, reported having a higher incidence of ever having engaged in sexual intercourse, at 45%. This survey was given to 500 Tottenville students on November 13, 2000. Of these 500 students, 13 students declined to fill out the survey resulting in a sample of 487 students. A copy of this survey is located in the appendix of this proposal. Charts depicting the results of this study are also located in the appendix. Staten Island is

[1] Sexual activity is defined as having had sex within the past 3-month period.

slightly lower than the national rate for students who are currently sexually active (students who have had intercourse in the past 3 months) with 30%, compared to the nation's 36.3%. When questioned about their sexual activity, Tottenville students reported that 32% of students were currently sexually active. Sexual activity has not declined significantly as have the rates of other sexual behaviors, but rather has remained somewhat constant over the past decade, which makes lowering its occurrence one goal for sexual education to strive for. Staten Island and Tottenville both rate lower than the nation on condom use (53% and 54% respectively compared to the nation's 58%), and the use of birth control pills (15% and 12% respectively to the nation's 16%). In general, Staten Island seems to lag behind the nation's improvement in decreasing teen pregnancies. In 1998, Staten Island's local rate of teen pregnancies in 15-19 year olds was 6.82% (health.state, 2000). In the same year, the nation's rate of teen pregnancies for the same age group was a significantly lower 5.11%. Tottenville students, when surveyed, reported only 5% of 15-19 year olds ever having been (or having their partner be) pregnant.

Obviously, although Staten Island teens are having less sexual intercourse than the average student across the nation, they lack either the knowledge or the incentive to use any of the various birth control options that are available to them. Studies by the Children's Hospital Medical Center in Cincinnati have shown details concerning the prevalence of teen pregnancy across the nation. They have found that 20% of teens that have sex will become pregnant within the first month of sexual intercourse, and 50% will become pregnant within 6 months (Chamberlain, 2000). It is clear that although great strides have been made in reducing risk behaviors amongst teens, there is still much work to be done.

Health Education in Tottenville High School

Tottenville High School's current sexual education protocol is a part of a comprehensive health program offered to students for one semester in place of a physical education, or gym class. The sexual education component of the health program is rather scientifically based. Students are taught about the reproductive systems, various sexually transmitted diseases, and contraception. Abstinence is promoted as the best way of guaranteeing a healthy life; however, if students do decide to engage in sexual intercourse, the program promotes the use of condoms as means of protecting oneself. Students are urged to "just say no" to sex. Very little time is spent on teaching students how to avoid situations in which they may be pressured into sexual behavior or how to address these situations if they do arise. This health class is mandatory for graduation; though the class is not given at any specific year. Very often students take this class in their senior year to prevent having gym their final year of school. However, during the senior year, students are already 17 and 18 years old. As stated above, 50% of students have already engaged in sexual intercourse by the age of 17; therefore, participating in a sexual education class in the senior year will not prevent the initiation of sexual activity for approximately one half of these students. Physical education teachers and sports team coaches, who often have not had specific training in risk behavior prevention education, most often teach these classes. Also, as a supplement to the health class, students receive a sexual education "booster" in their physical education classes. These supplements usually last 3-5 days and are not terribly informative, focusing on abstinence, or condom use to prevent pregnancy and HIV/AIDS. The information usually involves quite basic, well-known facts. Very often more than one day,

perhaps the entire school week will be devoted to watching a video of a personal account of some aspect of sexual behavior.

The current program, although informative, has been rather ineffective in promoting healthy behaviors and preventing sexual risk behaviors. In order for Tottenville's students to lead the healthiest lifestyles possible, the sex education program needs to be reorganized. The class needs to be offered to students sooner in their academic careers. The teaching methods used in the classes need to be more action oriented rather than the current traditional lecture styled classroom environment. This will help to promote student participation, and ultimately allow the students to carry out the healthy behaviors promoted in the classroom.

LITERATURE REVIEW

" Every school day, 50 million young people attend more than 110,000 schools across the nation. Given the size and accessibility of this population, our schools can make an enormous positive impact on the health of the nation."

- Centers for Disease Control and Prevention (2000)

Rigorous studies have shown that health education programs in schools effectively reduce the prevalence of health risk behaviors among young people. However, not all health and sex education programs are created equal. There are different types of programs taught around the nation all with different curricula. The CDC recommends a comprehensive health program as the most effective and preferred curriculum in promoting health behaviors (cdc.gov, 2000). The graphic on the title page of this proposal shows the elements of the CDC's ideal health program for schools.

The Centers for Disease Control (CDC) has developed a definition of the key elements of a comprehensive health education. A program must be a documented, planned, and sequential program of health instruction for students. Programs must also involve a curriculum that addresses and integrates education about a range of categorical health problems and issues at developmentally appropriate ages. For sexual education this should be middle school through high school aged children. These programs should be provided for a prescribed amount of time at each grade level and should be taught by instructors trained to teach the subject. Coordination of such programs should be by an education professional trained to implement the program. These programs should be periodically evaluated, updated, and improved, and should involve not only school officials but should also include parents, health professionals, and other community members (cdc.gov, 2000)

Reducing the Risk: An Overview

In order to aid schools in implementing effective prevention programs, the CDC has developed the Programs that Work project. This project helps schools identify curricula that effectively reduce sexual risk behaviors that contribute to HIV and other STD infections, as well as unintended pregnancy. The project also provides information and training for educators from state and local education agencies often through each state's individual Board of Education. One such program is the Reducing the Risk program (cdc.gov, 2000). This is not designed to be a stand-alone program, but rather will be embedded in the context of a comprehensive family life or health education program, such as the program Tottenville currently has. The Reducing the Risk program is grounded in the educational basis that "learning comes from action" (Barth, 1996). The development of its curriculum is a combination of several theoretical approaches to learning. These approaches are the social learning theory, the social inoculation theory, and the cognitive behavior theory. The foundation behind the Reducing the Risk curriculum maintains that adolescents and young adults need cognitive and behavioral skills to resist pressures and successfully negotiate interpersonal encounters. The program has three main components:

activities (such as role-play) to personalize information about sexuality, reproduction, and contraception; training in decision-making and assertive communication skills; and practice in applying these skills in personally difficult situations (Kirby, 1991).

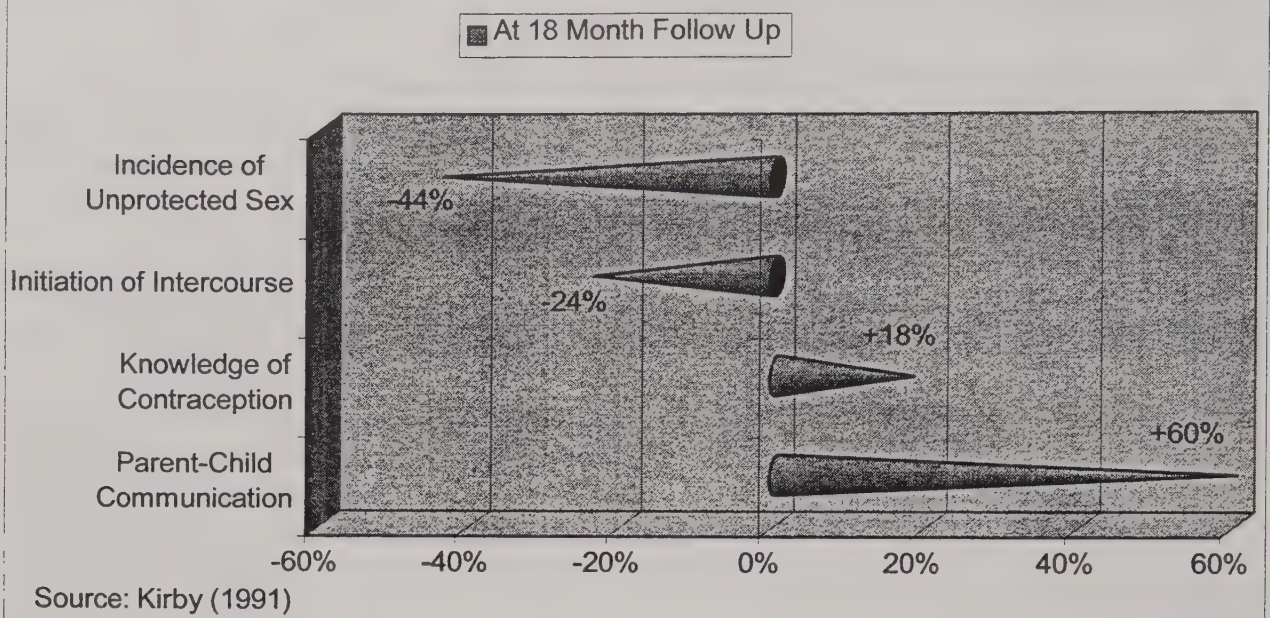
In addition to the CDC's criteria for a comprehensive health education program, Dr. Douglas Kirby, Ph.D. has outlined eight characteristics which effective curricula share. Effective programs should include a narrow focus on reducing sexual risk-taking behaviors that may lead to HIV/STD infection or unintended pregnancy. Programs should be based on theoretical approaches that have been demonstrated to be effective in influencing other health risk behaviors. Effective programs tended to last either 14 or more hours or were shorter, but were limited to a small group of people. These programs must also employ a variety of teaching methods designed to involve the participants and have them personalize the information (role-play, small group discussions, interviewing parents, visiting clinics, simulations, and brainstorming). Programs provide basic information that students need to assess risks and avoid unprotected sex. Curriculum should include activities that addressed social pressures on sexual behaviors (discuss common "lines" used to obtain sex and how to approach them). Programs should reinforce clear and appropriate values in order to strengthen individual values and group norms against unprotected sex. Finally, these programs should provide modeling and practice of communication and negotiation skills. The Reducing the Risk program fulfills all of these criteria (Kirby, 1995).

Effectiveness

This program was first implemented in 13 California high schools to test its effectiveness. This study covered students of high school ages, both males and females, and various ethnic and racial groups to ensure it would be effective in groups which varied demographically. Students were randomly assigned to classes that were either treatment (utilizing the Reducing the Risk curriculum) or comparison (utilizing a traditional sexual education curriculum) groups. All students were given questionnaires that surveyed their current sexual status, and tested their knowledge of sexual issues (including contraception, sexual health etc.). These questionnaires were given to students before participating in the program and then at six and eighteen month follow-ups after the intervention. Dr. Douglas Kirby performed this independent evaluation of the Reducing the Risk program in 1991. After statistical analysis of this evaluation was completed, the program was found to be effective in a number of ways in which the comparison group was lacking (Kirby, 1991).

One of the most positive results of this program was its effect on the initiation of intercourse by students. This program was proven to decrease initiation of sexual intercourse by participants by 24%. In those students who did initiate intercourse after participation in the program, the likelihood of them to engage in unprotected sex decreased 44% compared to the group who did not received the intervention. Perhaps the greatest achievement of the program concerned communication. Students were

Figure 2: Results of the Reducing the Risk Program



Source: Kirby (1991)

much more likely to communicate with their parents concerning abstinence and contraception. This was an increase of 60% over the comparison group. The students also had an increased knowledge (18% greater) regarding contraception, pregnancy risk, and HIV/STD prevention.

PROPOSAL

I believe Tottenville High School students would best benefit from the Reducing the Risk program offered by the CDC. It would easily replace the section that is currently taught in the existing health education program. Reducing the Risk is meant to be a part of a comprehensive health program. This is exactly the type of program that Tottenville already has established in its curriculum. This will make for a rather simple transition from the old sexual education curriculum to the new program.

Step 1: PARENT NOTIFICATION

The first step in this process would be to notify parents of the change in curriculum. Tottenville already has a monthly newsletter that gets sent out to the parents of students. An article regarding the new curriculum would be in each newsletter for the spring semester (January through June 2001) before implementation of the program in the fall of 2001.

Step 2: TEACHER TRAINING

The second step in implementing the new program would be to have the teachers trained in the new program. There is minimal new information in the program. Rather, the teachers need to be instructed on how to run the classroom so that the students take an active role in their own education. The teachers will be instructed on the three approaches which are the basic theories supporting the program. There is a 1 or 2 day workshop geared toward preparing the school team for adoption of the new curriculum. A 3-day training workshop prepares teachers to implement Reducing the Risk in the classroom by familiarizing them with the curriculum's theory and evaluation, key lessons, and how to facilitate effective student role play. This training is provided by the CDC through the New York State Board of Education and is free for participating teachers and coordinators (cdc.gov, 2000).

Step 3: MATERIALS

The next step will be ordering the materials needed for the program. Necessary materials include the Teacher's Manuals and Student Workbooks, estimated at approximately 1,000 workbooks per year. There is also an optional activity kit that contains posters and role-play cards that aid the teacher in running the classroom. The activity kit will not be provided but will be available for the teachers to purchase if they so choose.

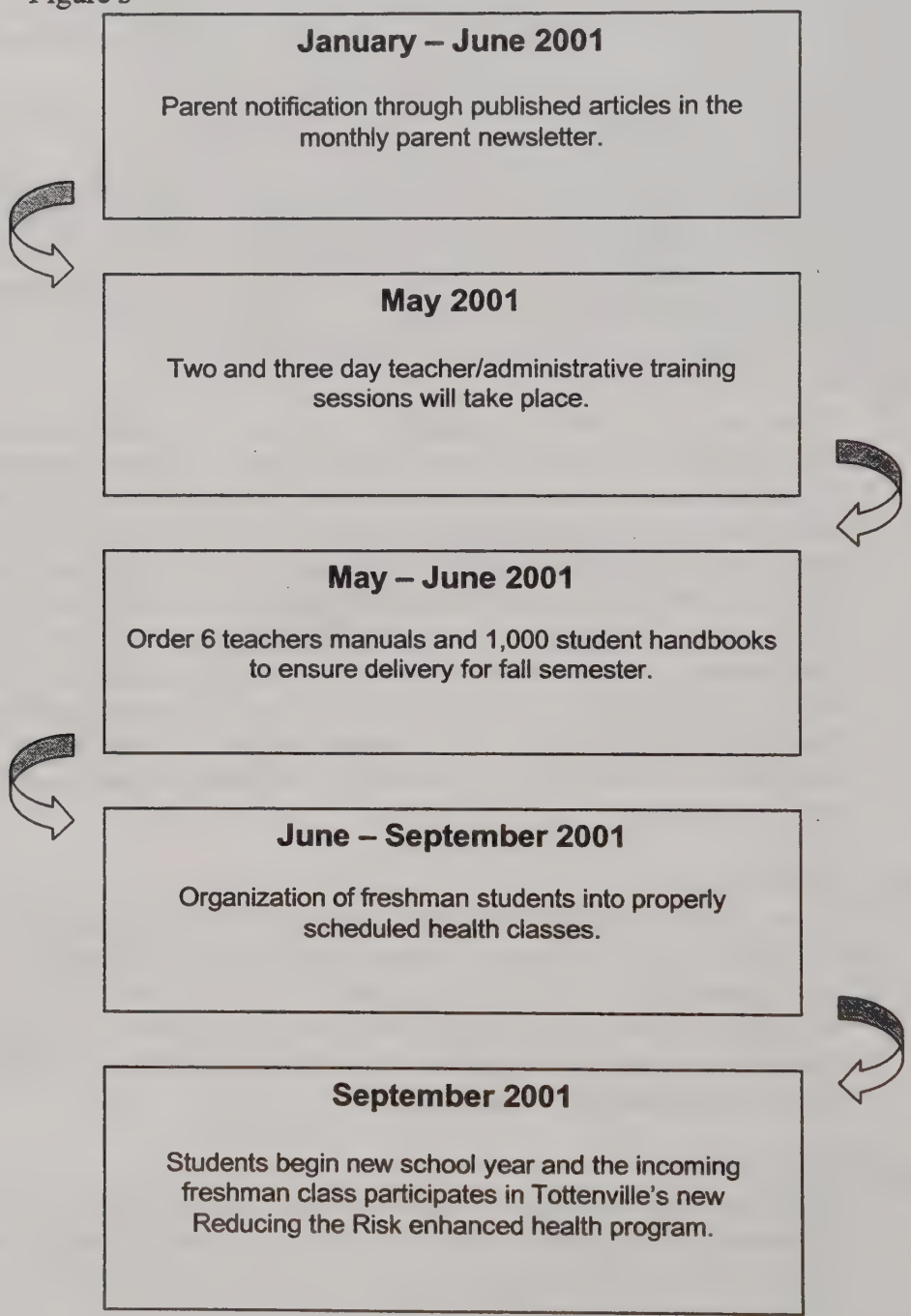
Step 4: ORGANIZATION

Finally, the students would be organized into programs making it mandatory for all incoming freshmen to participate in the program during their freshman year. There would be approximately 500 freshman students per semester (x 2 semesters per year) enrolled in the health program. It is simply too late for a student to take such a class in their senior year, when approximately one half of the students have already engaged in sexual intercourse. In order to prevent sexual risk behaviors

effectively, the program must be taken before the students have engaged in sexual activities. Therefore, the best chance to be effective would be to make all students enroll in the class their first year of high school.

Timeline

Figure 3


January – June 2001
Parent notification through published articles in the monthly parent newsletter.
May 2001
Two and three day teacher/administrative training sessions will take place.
May – June 2001
Order 6 teachers manuals and 1,000 student handbooks to ensure delivery for fall semester.
June – September 2001
Organization of freshman students into properly scheduled health classes.
September 2001
Students begin new school year and the incoming freshman class participates in Tottenville's new Reducing the Risk enhanced health program.

BUDGET

The cost of implementing the program is small. The following budget is for the first year, after which there will not be a need to order new teacher's manuals, lowering the next year's budget to $4,000.00. Also, to defray the cost of the student workbooks, the students may be asked to contribute a fee such as the lab fees they are charged in their other classes.

Materials:

Teacher's Manuals (6 x $42.95 + S&H).....$300.00
Student Workbooks
($18.95/5 workbooks x 200 packages of 5 + S&H).....$4,200.00

Training:

X 6 teachers.....$0
X 1 administrator.....$0
(Training provided free by the CDC through the NYS Board of Education)

Salaries:

X 6 teachers.....$0
X 1 administrator.....$0
(Teachers will come from Tottenville's existing physical education staff.)

Total:.....*$4,500.00*

DISCUSSION

Teenagers are well known to engage in the riskiest of behaviors. Unprotected sexual activity is among the most dangerous of these behaviors. Every year, three million cases of sexually transmitted infections and one million pregnancies occur among teenagers across the nation. The nation's first line of defense to prevent these behaviors is the health education program in secondary schools. In Staten Island, Tottenville High School students in particular are not as sexually active as the national average, and that in and of itself shows progress. However, Tottenville and Staten Island have lower than average rates of condom use and birth control use. These are behaviors that can have serious, life long, and even deadly repercussions. Tottenville's current health education program has been inadequate in preventing risk behaviors among its teenage population. In order to promote healthy lifestyles, Tottenville must upgrade its sexual education program to one that has been proven to prevent risk behaviors and promote healthy lifestyle decisions.

The Reducing the Risk curriculum is one such program. Reducing the Risk calls for an active teaching style that has been evaluated by the Centers for Disease Control and Prevention and has been designated as a Program that Works. Upon completion of the program, students will be able to evaluate the risks and associated consequences of becoming a teenage parent. Students will also be able to acknowledge that abstinence, or consistent use of protection (i.e. condoms) is the only way to avoid pregnancy and sexually transmitted diseases including HIV. Students will also be able to demonstrate effective communication skills to remain abstinent and/or avoid unprotected sexual intercourse. Parent-child communication concerning sexual behaviors and other sexual topics was drastically increased after participation in this program. These positive results were achieved in populations demographically equivalent to that of Tottenville's student body. These are precisely the results that are needed in Tottenville. Most importantly, the program will be mandatory for incoming freshmen to take during their first year of high school since results of the program are optimal if the course is taken prior to initiation of intercourse. Implementing the program is simple and cost-effective, the only expense being teacher manuals and student workbooks with teacher training provided free by the New York State Board of Education. With this program, Tottenville High School can reap maximum benefits with only minimal costs.

Evaluation

In order to ensure that the program is as successful in Tottenville as it has been in the past, it must be evaluated. Therefore, during the first 2 years in which the program is run incoming freshman will be given questionnaires quite similar to those used in the initial evaluation of Reducing the Risk. The questionnaires will test knowledge of contraceptives, pregnancy risk, and STD/HIV. It will also find the students' sexual status, that is whether or not they have had sex, are they currently sexually active, and if so, do they use condoms, birth control pills, or some other means of contraception. The students will then participate in the program and will be followed up with the same questionnaires one year later. The same questionnaires will be given to older students who had participated in the current sex education program. The results of each group's questionnaires will be compared to find if the Reducing

the Risk program is more successful in preventing risk behaviors in Tottenville High School than the current program is.

Also, in accordance with the Center for Disease Control and Prevention's guidelines for an appropriate comprehensive program, Tottenville should routinely evaluate, update and improve the program to maintain its effectiveness.

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APPENDIX A-1

Modified Risk Behavior Survey

This survey is part of a research project that requires accurate and **honest** results. PLEASE do not put your name on these surveys. This is to protect your confidentiality. In no way will the results of the survey be tied back to you. The subject matter is somewhat sensitive and participation in the survey is completely voluntary so if at any time you feel uncomfortable simply do not fill out the questionnaire. Thank You.

Please circle the answer which best describes you or your situation:

1. Age: 13 14 15 16 17 18

2. Gender: Male Female

2. Grade level: Freshman Sophomore Junior Senior

3. Have you ever had sexual intercourse? Yes No

4. Age at first sexual intercourse: <12 12 13 14 15 16 17 18 N/A

5. # of partners with whom you have had intercourse: 1 2 3 4 >4 N/A

6. Have you had sex in the last 3 months? Yes No

7. Did you or your partner use a condom the last time you had sexual intercourse?
Yes No

8. The last time you had sex, which method of contraception did you use?
Latex condom Spermicide Sponge Diaphragm
Birth control pills IntraUterine Device No Contraception Used

9. Have you ever had unprotected sex? Yes No

10. Have you or your partner ever been pregnant? Yes No

Thank you again for your time and honesty. It will be of great help in the development of the research project.

APPENDIX A-2

Results of the Survey in appendix A-1.

Figure 4: Tottenville's Condom Use

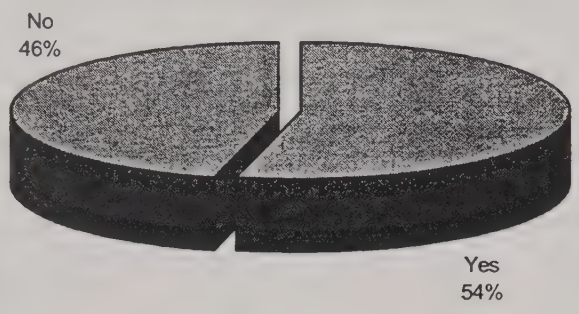


Figure 5: Tottenville's Birth Control Use

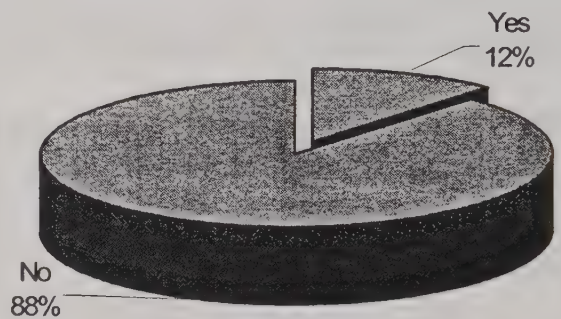


Figure 6: Tottenville Students' Age at 1st Sexual Intercourse

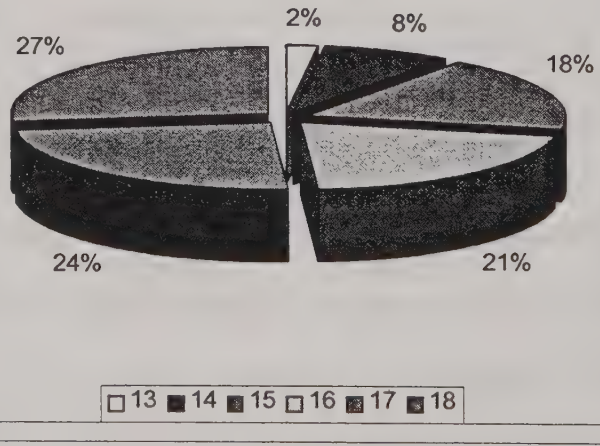
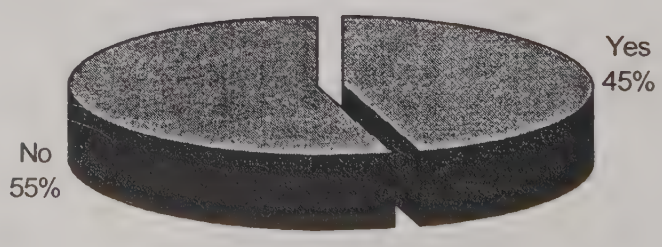


Figure 7: Students Who Have Ever Had Sex



Proposal for MCF Research

Daniel's project is timely in the wake of the various ruminant epidemics of the past few years. He identifies the problem on several levels and uses good argument strategy for a research proposal. In discussing the problems associated with our lack of knowledge about the transmission of MCF and the beneficial implications of what the research will show us, he offers his funding source an opportunity to advance the field of animal husbandry. Interesting graphics add to his plan section and help make the proposed experiments easier to visualize.

00000 CPO WAY
New Brunswick, NJ 08901
December 11, 2000

Bruce Carlton, Executive Director
New Jersey Agricultural Experiment Station (NJAES)
Cook College – Rutgers University
88 Lipman Drive
New Brunswick, NJ 08901

Dear Dr. Carlton,

The enclosed proposal deals with the mode of transmission of Malignant Catarrhal Fever and its effects on ruminants. As head of a state funded program and Land Grant college, your mission is to emphasize research and outreach, applying the results of that research to contemporary and foreseeable problems in agriculture, the environment, food and nutrition, and precious natural resources. Since the specific aim of your program is to fund the latest projects that will enhance scientific agricultural and farming knowledge of the public of New Jersey and the United States, I believe that you will be interested in the project that I propose in this area.

Malignant Catarrhal Fever is a major disease that affects most ruminants here in the United States and throughout the world. It contributes to major losses of herds for many game and cattle ranchers. Research has shown that it is a very deadly retrovirus that sheep can actually carry and pass on to other ruminants. Other than that, little is actually known about Malignant Catarrhal Fever. Current procedures are to house sheep herds as far as possible from other ruminant herds to try to stop the spread of the virus. However, sporadic cases of Malignant Catarrhal Fever still do occur.

My proposal can easily be implemented at the working farm at Cook College, making it perfect for your agricultural and farming research program. Many of United States' game and cattle ranchers will benefit in knowing how to keep their herds safe due to the results of experiments which study Malignant Catarrhal Fever transmission. They will be less likely to have unfortunate huge losses in profit due to the disease. This will help fulfill your goal of heightening the quality of life of all New Jersey residents.

Thank you for your time and consideration. If you have any questions or comments you can reach me at the above address, or at (xxx) xxx-xxxx, or at xxxxx@hotmail.com.

Sincerely,

Daniel Tierney

Malignant Catarrhal Fever

Proposed Experiments on Transmission

Submitted by: Daniel J. Tierney

Submitted on: December 11, 2000

Submitted to: Executive Director Bruce Carlton
New Jersey Agricultural Experiment Station
Cook College – Rutgers University
88 Lipman Drive
New Brunswick, NJ 08901

Final Proposal for Scientific and Technical Writing
Barbara Hamilton
Loree 036
Cook College – Rutgers University

Abstract

Throughout the world, Malignant Catarrhal Fever is one of the most deadly diseases that affect captive ruminant herds, such as cattle, deer, sheep and goats. Yet, not much is understood about the virus. The mode of transmission still remains unclear. Two strains of the virus are known. The one that is most common in affecting ruminant herds is the sheep-associated Malignant Catarrhal Fever. Studies have shown that 98% of sheep and 80% of goats are infected with Malignant Catarrhal Fever. They seem to act as carriers, showing no clinical signs themselves. That is why it is standard procedure to keep sheep and goats as far away as possible from other ruminant herds.

Malignant Catarrhal Fever is a retrovirus. Previous studies have looked for the mode of transmission for other retroviruses, such as HIV in animal models. Data was taken from a series of experiments, each of which studied only one means of transmission, while isolating all others. They were successful in finding the mode of transmission of HIV. In this proposal, a series of experiments similar to those of Letvin and Gluckman are called for. It acts to find the mode of transmission of Malignant Catarrhal Fever. This proposal has the potential to decrease the chances of the herds' susceptibility to Malignant Catarrhal Fever through knowledge of prevention of the spread of the disease, both in the United States and around the world.

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Introduction

Malignant Catarrhal Fever is a retrovirus, like HIV. Many game and cattle ranchers are plagued with this virus. It is a sporadic virus that attacks herds and mostly always kills those animals that are infected with it. It is extraordinary that the cause of Malignant Catarrhal Fever, which is one of the most dramatic virus-induced animal diseases, is still poorly understood. The fact that Malignant Catarrhal Fever has emerged as the single most important disease of farmed deer gives an urgency to resolving this problem if the industry is to prosper (Reid, 1988).

Malignant Catarrhal Fever was originally reported in Europe as a disease of cattle but has subsequently been recognized to occur worldwide. This virus affects ruminants, such as cows, deer, goats and sheep. There are also two strains of the disease. They are alcelaphine herpesvirus-1 and ovine herpesvirus-2. As stated in Buxton(1988), Malignant Catarrhal Fever can present itself as peracute, acute, subacute or chronic disease. In peracute cases, the animal may die with no prior clinical signs having been noticed and the only way to tell is through a post mortem examination. In chronic cases the animal appears sluggish and has a loss of appetite. A higher body temperature occurs, as well as a watery nasal discharge followed by increased salivation. The animal will then have difficulty breathing, severe diarrhea and swollen joints. If the animal either has acute or chronic forms of the disease, the cornea of the eyes will become cloudy and the lymph nodes will enlarge (Fraser, Stamp, Cunningham, 1987). An animal infected with the disease usually dies within 5-8 days.

Cases of MCF

Cases of Malignant Catarrhal Fever are being documented all around the world. Game and cattle ranchers are affected, but they are not the only ones. Other facilities are affected by the Malignant Catarrhal Fever virus as well. Such facilities include zoos and research centers.

Over a four month period 23 of 28 white-tailed deer kept at a small zoo in New Jersey had died of Malignant Catarrhal Fever. Clinical signs prior to death were minimal and consisted of depression, nervous system disorders, and severe diarrhea in a few animals only. Autopsies revealed widespread lesions on the heart, lungs, liver, and intestines (Brown & Bloss, 1992). Many of the deer died of starvation because they were reluctant to feed, a few deer died of seizures, and others were simply found dead. It is believed that the white-tailed deer had died of sheep-associated Malignant Catarrhal Fever, do to the fact that the zoo also housed 20 sheep. A puzzling feature is that the sheep and deer were separated by a large distance, from 100 to 200 meters. However, in some cases of Malignant Catarrhal Fever in deer, there was little or no apparent contact with sheep. Some suggested that transmission occurred from deer to deer. This is

impossible, though because it turns out that deer seem to be dead end hosts (Becker & Katz,1999). In deer, there seems to be a greater tendency for large numbers of animals to be affected than in cattle. This case was extreme in that regard (Brown & Bloss,1992).

Another case hits a little closer to home. Through a period of seven years (1992-1998) a herd of 32 captive white-tailed deer at the Cook College research farm had died of Malignant Catarrhal Fever or unknown causes. The problem was that Cook College did not know that it had an outbreak of this virus on its hands. Not until a concentrated die-off in 1997 did they identify that this disease was prominent in the herd. Past autopsy reports gave enough data to assume that the deer from 1992-1996 had died from Malignant Catarrhal Fever as well (See Table 1). The probable cause of transmission was most likely due to the fact the deer were housed in close proximity to the sheep and goats.

Table 1

Deer Mortality due to SA-MCF or Other Causes in the Cook College Captive Herd (Becker & Katz, 1999)

Year	MCF	Probable MCF	Possible MCF	Other
1992	0	0	4	4
1993	0	1	1	1
1994	1	0	0	1
1995	0	2	2	0
1996	0	2	1	0
1997	6	3	0	1
1998	1	1	0	0
Total	8	9	8	7

Diagnosing an animal with Malignant Catarrhal Fever must be done during a post mortem examination. Erosion of the nasal mucosae and hemorrhage in the large intestine can be found. Also, upper respiratory lesions are noticeable along with lesions on other major organs, such as the kidneys. Another way to diagnose the animal is to take a virus antibody count. The only problem is that 25-30% of deer and cattle dying of Malignant Catarrhal Fever fail to produce detectable antibody until about 24 hours prior to death. Sheep and goats, on the other hand, are different. Studies show that 98% of all sheep and 80% of all goats are infected with Malignant Catarrhal Fever. Since they act as carriers, they transfer the virus to other ruminants without showing clinical signs themselves (Becker & Katz, 1999). Since present detection does nothing to prevent herd loss, new information is needed to detect if Malignant Catarrhal Fever is present in an area or within a herd, or the mode of transmission must be found so that ranchers can protect their herds from contracting this terrible disease.

Literature Review

Previous Studies on MCF

There have been previous studies on Malignant Catarrhal Fever, but much of the virus still remains a mystery. The ovine herpesvirus-2 is the type of Malignant Catarrhal Fever that is carried by sheep and possibly goats, but is usually called sheep-associated MCF (SA-MCF).

A study by T.B. Crawford (January, 2000), a leading scientist in the study of this virus, was conducted at Washington State University to see how the Malignant Catarrhal Fever virus was transmitted from infected sheep to non-infected sheep. The study consisted of two parts. The first part was to see if the virus was transmitted through blood. Blood samples were taken from infected sheep and then injected into non-infected sheep. It turned out that 40% of the sheep actually became infected. In the second part, however, infected and non-infected sheep were housed in the same area and through just normal contact, 100% of the sheep became infected. This is very interesting because this study shows that blood transfer is an unlikely source of transmission. Another study to support this hypothesis was conducted with rabbits and cattle, which showed that the blood contained trace amounts of the virus until about 24 hours before death (Rossiter, 1985). This information will help with my experiment study because a blood transfer test will not have to be done. As can be seen, the virus is transmitted through contact somehow. Other factors are involved which will be brought up in the plan section of the proposal.

Other experiments have used animal models to study the mode of transmission of HIV. Animal models have proven to be of great importance in clarifying the immunopathogenesis of HIV. Studies have involved the use of simians, felines, rabbits, mice, and sheep to explore HIV in order to create strategies for its prevention. In some experiments, scientists would take infected plasma or tissue samples and inject the non-infected host in certain areas of the body to see if the virus affected only certain organs or the body as a whole. In other experiments, one possible factor of transmission was expressed, while all other possible factors were isolated. This allowed scientists to see if the one factor that was being expressed caused the virus to be transferred to a non-infected host, such as through feces or saliva. Instead of transferring the virus artificially with plasma samples, these studies allowed the virus to be contracted naturally, simulating a more natural transmission within a semi-controlled environment. After these experiments were finished, the results showed that a mode of transmission had been found (Letvin & Gluckman,1993). I plan on using the same techniques as these scientists who were successful in finding the mode of transmission in HIV and other retroviruses, as a basis of my experiments.

Factors of Transmission

There are many factors that could possibly cause the transmission of Malignant Catarrhal Fever to domesticated ruminants, such as cattle and deer, on ranches and farms. Even though sheep and goats are usually kept far away from other ruminants, the disease may still be contracted. If Malignant Catarrhal Fever is air borne, it will be very difficult to control. Many farmers and ranchers only have so much land to utilize. Keeping sheep or goat herds and other ruminant herds as far away from each other as possible then may not be enough. The virus may also be transmitted via birds or parasites (Becker & Katz, 1999). If that is the case, it will also be nearly impossible to control. Birds travel wherever they please. If the ruminants are not in contact with them inside the barns, then they are in contact with them outside during grazing periods. The birds may act as carriers, transferring the virus through their feces. Parasites may also carry the virus. Studies to determine if parasites may be a cause of transfer have not been performed or published to date.

Ruminants are all foragers. They forage for high-quality, easily digestible plant parts. Their anatomic, behavioral, and physiologic adaptations allow them to select nutritious forage and obtain the easily digestible nutrients quickly (Demarais & Krausman, 2000). As a rancher's cattle or deer forage for food on the pastures, they will come in contact with the urine and feces of the sheep if pastures are shared by both herds at different times or if a rancher alternates pastures for each herd. Experiments have been conducted to see if saliva causes virus transmission. Like the feces, the infected saliva could be located on the plants in the pasture and can be transferred to the other ruminants. The saliva, like the urine, could also even be soaked into the ground of the pasture and can contaminate ground water that could collect into puddles, which the other ruminants may drink out of when thirsty (Letvin & Gluckman, 1993).

In all studies, there is a chance that the caretakers or scientists themselves can contaminate the results. Precautions must be taken by the caretakers in order to minimize as many unwanted factors as possible (Loew, Bennett, Blake, Cunliffe-Beamer, Hughes, Pakes, Simmonds, & Strandberg, 1987). If there is only one caretaker who has to handle different animal groups during a study, that person should change clothes and wash thoroughly before moving from one animal pen to another. It is better, however, to have different caretakers for each model to minimize the possibility of one animal group from infecting another animal group through contamination. At a ranch or a farm, this mode of transmission is possible because as the caretaker feeds and cleans the pens of the infected groups, he/she comes in contact with the feces, urine, saliva, and even parasites that may carry the disease. This caretaker may unwittingly transfer the disease to the non-infected group, hence it is necessary to experiment if this factor is an acting mode of transmission.

Proposal

These experiments are modeled after the series of experiments performed by Letvin and Gluckman on HIV transmission. A series of experiments will be performed, each experiment expressing one possible mode of transmission, while isolating all other possible factors. At the end all data and results will be analyzed to find the mode or modes of transfer that Malignant Catarrhal Fever may use. Since Malignant Catarrhal Fever is a retrovirus, I believe that by studying other retroviruses, such as HIV, more can be found about the unknown virus. Since Malignant Catarrhal Fever and HIV are both retroviruses, characteristics between the two should be similar.

For these experiments I will need 70 sheep: sixty non-infected and ten infected with Malignant Catarrhal Fever. I will be studying sheep to sheep transfer because I do not wish to sacrifice so many deer for this study. The mode of transfer should be the same for sheep to sheep transfer as for sheep to deer transfer. Four pens will be needed. They will be provided by the Cook College farm. Two pens will be used, one to house the group of non-infected sheep and one for the infected sheep that will not be involved in experiments. These two pens will be housed far away from one another in order to keep both groups of sheep isolated from any contact and any accidental transmission of Malignant Catarrhal Fever. The other two pens will house the sheep that are involved in the active experiment at that time. There will be 6 experiments, each experiment using 20 sheep (10 non-infected and 10 infected), of which I will act as supervisor. The same infected sheep can actually be used in each experiment. Each experiment will take about 4 months to ensure transmission of the virus. That means a total of 24 months will be needed to run these experiments. At the end of each experiment, an enzyme-linked immunosorbent assay (ELISA) or PCR will be taken to count the level of Malignant Catarrhal Fever antibodies in the non-infected sheep to see if they have become infected.

Cook College farm employees will begin the construction of the barriers in the experiment pens during the summer of 2001. The actual experiments will start at the beginning of the 2001 fall semester and last until the beginning of the 2003 fall semester. Twenty Animal Science Problems students will help in taking care of the animals and in performing the experiments. Students will sign up to work during the times that are convenient for them, so not all 20 students will be needed at one time. During the winter and summer breaks, Cook students will be employed to take care of the animals.

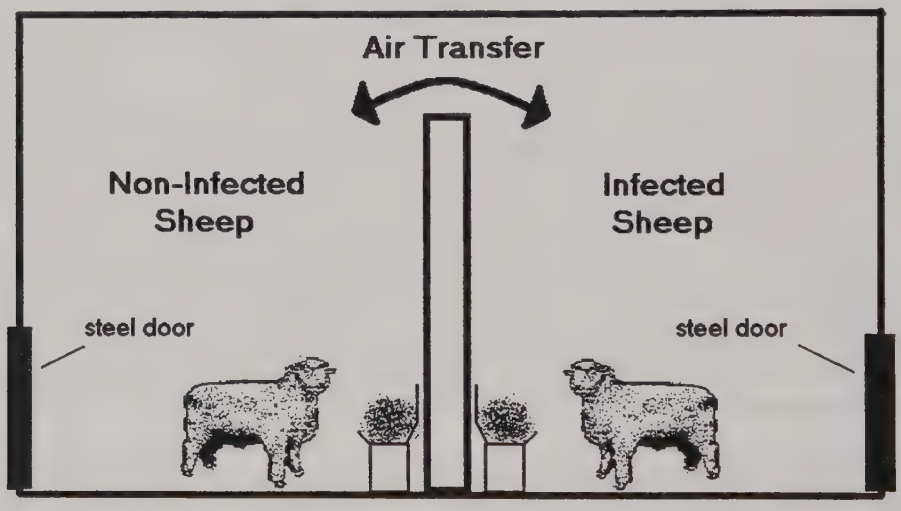
Experiments

In each experiment, these facts will remain constant so as to provide basic nutritional requirements:

- Free access to shelter and water
- Access to isolated pastures during certain parts of the day
- Fed a complete, pelleted ration, formulated for sheep
- Supplemental salt would be available *ad libitum*
- Each group will have its own caretakers (someone who works with the infected sheep will **not** work with the non-infected sheep as well)

1) **Air Transfer**
   - Both the infected and non-infected group of sheep will be completely isolated, except for an open area near the ceiling. This is to allow air to transfer and travel freely between both groups of sheep.
   - A steel door will be used to seal off the pen from the outside pasture area. This door will stop air from the outside from affecting the air on the inside, causing skewed results.
   - This experiment will be done during the winter months due to the fact that these sheep will not be allowed outside for the four months. Since pasture does not supply good quality forage during the winter, all the nutrients they will need will be supplied by the grain and hay. The sheep must not be exposed to long term exposure to outside air in order for the study results to not be contaminated.

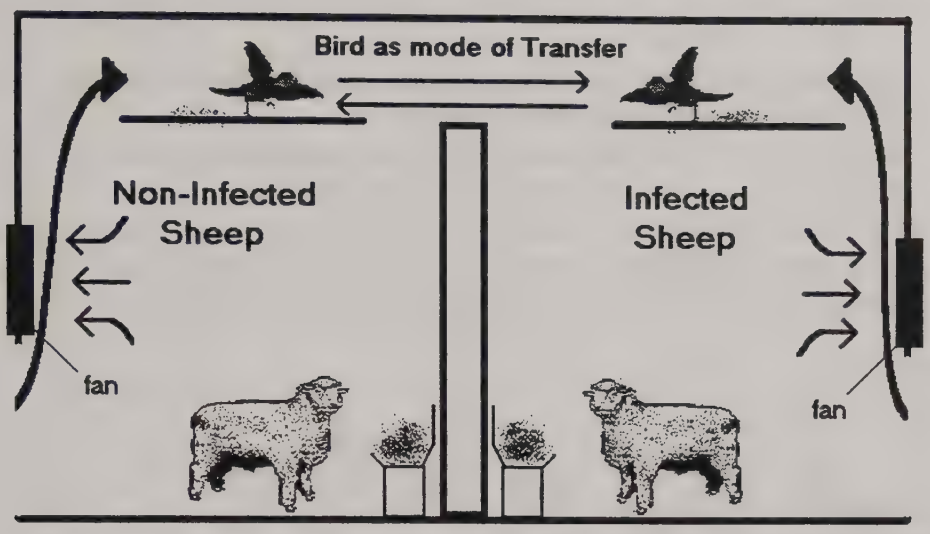
Figure 1



2) **Bird Transfer**[1]
   - The same pen that was used for the air transfer experiment could actually be used for this experiment. Both the infected and non-infected group of sheep will be completely isolated, except for an open area near the ceiling.
   - The steel doors will be removed.
   - Also, birdseed and nesting material will be placed inside of the pens. Both of these things will coax birds to take up residence in the pens, which will be allowed to transfer freely from the infected sheep to the non-infected sheep. (Birds often take up residents inside barns, they serve as excellent shelters)
   - Fans will be installed to remove any infected air from the pens so as not to interfere with the results.
   - It is thought that the birds may become infected themselves and act as carriers, spreading the disease to other animals through their feces.

[1] See Figure 2

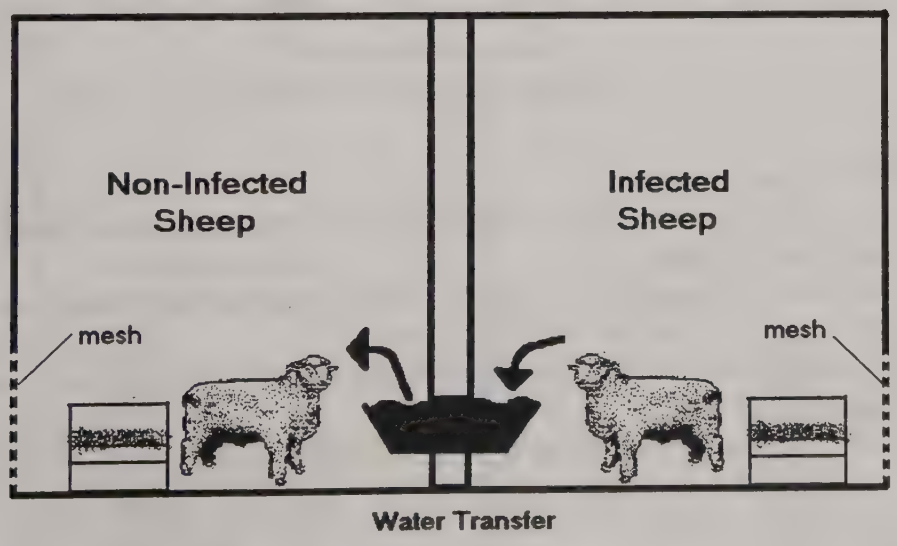
Figure 2



3) Saliva Transfer via Water Supply

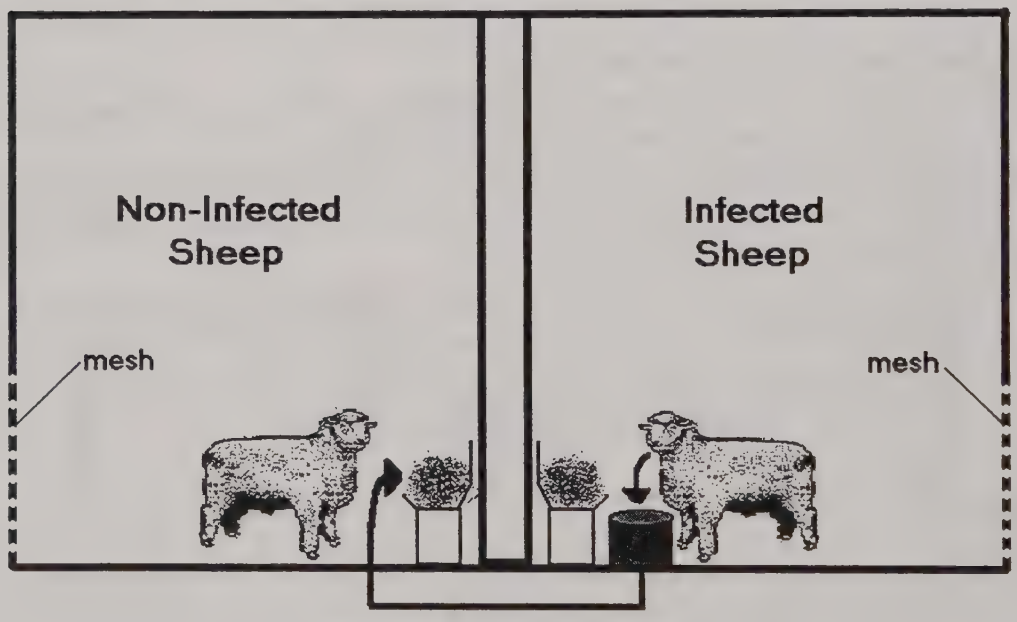
- In this experiment, both the infected and non-infected group of sheep will be completely isolated, except for their water supply.
- The same water source will be given for both infected sheep and non-infected sheep. A large trough will be built between the two groups of sheep. Each group of sheep will have access to it.
- This is to study to see if the virus can travel from the infected sheep saliva, through the water, and still infect the non-infected sheep.
- The doors to the pasture are now just metal gates covered in mesh, so as not to allow birds to come and affect the study.

Figure 3



4) **Saliva Transfer via Direct Saliva**
   - In this experiment, both the infected and non-infected group of sheep will be completely isolated.
   - The doors to the pasture are now just metal gates covered in mesh, so as not to allow birds to come and affect the study.
   - Saliva will be collected manually from the infected sheep and that saliva shall be placed and mixed in with the non-infected sheep feed.
   - To collect enough saliva, a local anesthetic can be given to the infected sheep. Most cause excessive salivation. If each of the 10 sheep is injected once a month, enough saliva can be collected and used for this experiment.

Figure 4

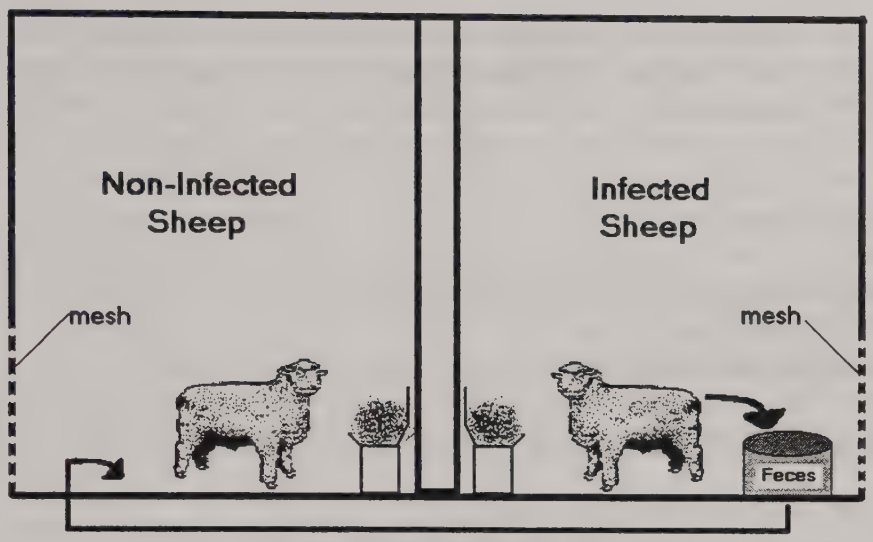


Saliva as mode of Transfer

5) **Feces & Urine Transfer**[2]
   - In this experiment, both the infected and non-infected group of sheep will be completely isolated.
   - The doors to the pasture are now just metal gates covered in mesh, so as not to allow birds to come and affect the study.
   - Feces and urine will be manually collected from the infected sheep before it touches the bedding.
   - The feces and urine of the infected sheep will be placed and mixed in the bedding of the non-infected sheep.

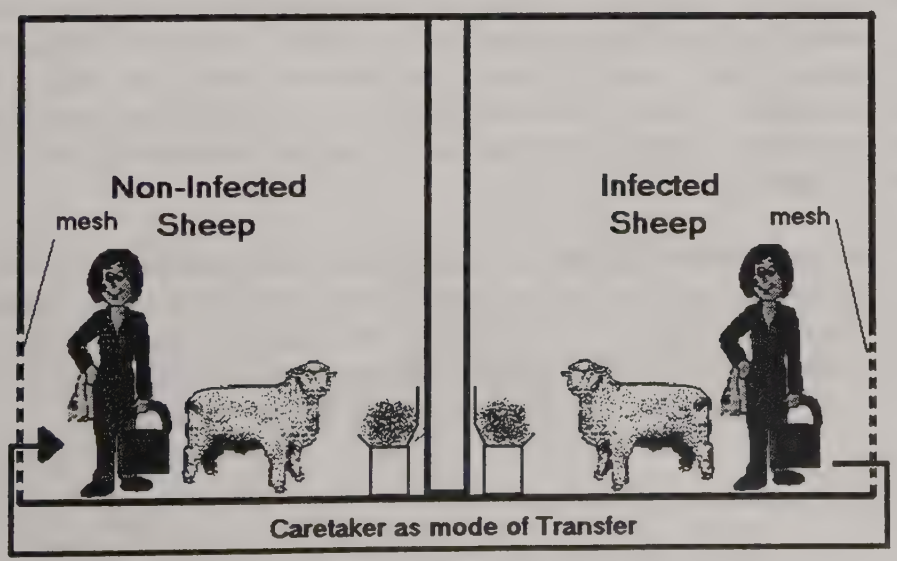
[2] See Figure 5

Figure 5



6) **Caretaker Transfer**
   - In this experiment, both the infected and non-infected group of sheep will be completely isolated.
   - The doors to the pasture are now just metal gates covered in mesh, so as not to allow birds to come and affect the study.
   - In all the previous experiments, each group of sheep was assigned one caretaker, so that the caretakers did not interfere with the results.
   - In this experiment, one caretaker shall take care of both groups of sheep, infected and non-infected.

Figure 6



Budget

The cost is minimal in comparison to the increase of knowledge that will be achieved once the experiments are completed. With this knowledge, game and cattle ranchers will most likely never see such huge profit losses again.

1. Cost of Sheep.....(70 X $75) = $5250
2. Cost of Construction Materials (if needed)..... = $1750
3. Cost of Laboratory Supplies..... = $1500
4. Cost of Feed & Bedding..... = $1500
5. Cost of Veterinary Care (if needed)..... = $2000
6. Salary for workers and supervisor (during school semesters)..... = $0
7. Salary for part time workers (during winter and summer break)..... = $5000
8. Approximate amount after sheep buyback.....(70 X $50) = +$3500

Approximate Total Cost = $13500

The four pens will not have to be paid for because the Cook College farm will supply them. Construction materials may not be needed. The Cook College farm may have all the materials that will be needed. The materials will be used for making the steel doors on the pens, creating the isolation barrier between both groups of sheep, and the shared water trough. If the farm has these materials available for use, the money will not be needed to buy them. I just wanted to allocate money to this cause in case the problem of needing materials would arise. If the farm can supply the construction materials, the money allocated for it will be given back to the NJAES. The Cook College farm employs workers year around. These workers take care of the farm, both in animal care and in farm repairs. These workers are employees of Cook College and they will help construct the different types of barriers that will be used in the study, since it is being performed on the Cook College farm.

The same situation applies to veterinary care. All researchers hope that their animals will not become ill or get hurt in some way during their study. However, it is always better to be prepared if a situation does arise. That is why I have also allocated money for this cause as well. However, if the money has not been used or if there is still money left, it shall be given back to the NJAES at the end of the study.

The question of caretaker salary may also present itself as you read the budget. It turns out that caretaker costs are $0. Cook College has a unique course that is offered to animal science majors called Animal Science Problems. For this course students get the chance to help out with undergraduate or graduate research projects, such as this. Up to twenty students are assigned to a project, so there will be more than enough help. This course benefits animal science majors because not only do they get experience working with the animals, but also receive up to two college credits. The students could actually work alone during basic feeding and cleaning of the pens and then assist me during the crucial parts of the experiments. The students will always be able to get in touch with me. My phone number and e-mail address shall be supplied to them in case they have any questions, or in case there is an emergency in which I have to be notified. Also, no extra precautions will have to be taken for the students because Malignant Catarrhal Fever has no effect on humans. I will be acting as supervisor during the series of experiments. I will not be paid for this project. Instead, it can be considered as an undergraduate research project, such as the George H. Cook projects here at Cook College. As a benefit, I will receive college credit for this study and a great experience to add to my resume.

There is another reason why my project will be inexpensive in the end. This is because at the end of the experiments, all of the finished sheep can be sold back on the market. Even though they have Malignant Catarrhal Fever, they can be sold back. It is not unusual because 98% of sheep already have the virus anyway. The profit that is made from selling the sheep to market will be given back to the NJAES.

Discussion

Malignant Catarrhal Fever may be an unknown virus; however, it cannot remain that way forever. Too many industries are being affected by this to just let it go unnoticed. Zoos, research facilities, and game and cattle ranchers have all suffered because of Malignant Catarrhal Fever. Not only do they lose herds of animals, but a potential profit of those animals is lost as well. This is why a mode of transmission must be found.

Since Malignant Catarrhal Fever is a retrovirus, I believe that by studying other known retroviruses, such as HIV, and their modes of transmission, an answer can be found about Malignant Catarrhal Fever transmission. That is why my experiments will model those of Letvin and Gluckman. Their series of experiments led to the discovery of how HIV was transmitted in animal models. Even if a mode of transmission is not found, the amount of knowledge that will be gained from these experiments will be substantial. This data could be given to the public or to scientists for further research analysis. Any further knowledge about Malignant Catarrhal Fever that could be gathered will still be beneficial to the scientific community. Other researchers would then know what does not cause transmission, and their studies could perform experiments that are different from my own in order to try to come up with an answer. However, the discovery of a mode of transmission from my experiments will affect everyone. Researchers will know how to protect their deer herds from contracting the virus, keeping the deer healthy and thus leading to better results on their research. Others, such as game and cattle ranchers, will also know how to keep their herds safe from Malignant Catarrhal Fever. They will no longer have to endure huge profit losses due to herd infection. This benefits us, the consumers, who buy meat such as beef by having decreased prices. This has implications for people throughout the United States and around the world. The first steps in finding a cure to any virus is to gain as much information as possible about the virus in question. My project results will aid in setting up these stepping-stones so that a cure can be found in the not too distant future.

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A Proposal to Improve Computer Lab Workstations

This project proposal begins with primary research to demonstrate the existence of a problem. Then, scholarly and professional sources are reviewed to see what the experts think should be done to remedy problems involving comfort and efficiency at computer workstations. Based on the research, the writer proposes a logical plan. This paper provides a good example of working within a paradigm in order to solve a real problem.

55 Handa Rd.
Edison, NJ 08817

October 12, 2000

Vernie Coston, Assistant Vice President
Committee on Computing and Information Planning
Facilities Design
82 Street 1603
Piscataway, NJ 08854

Dear Mr. Coston:

Thank you for attending the presentation of my proposal: An Ergonomic Approach for Improving Computer Workstations at the MSLC Computer Lab. A final draft of my proposal is enclosed with this letter. Workstation use is becoming more common as the computer revolution progresses. Along with this increased use, there are concern for ergonomic health issues.

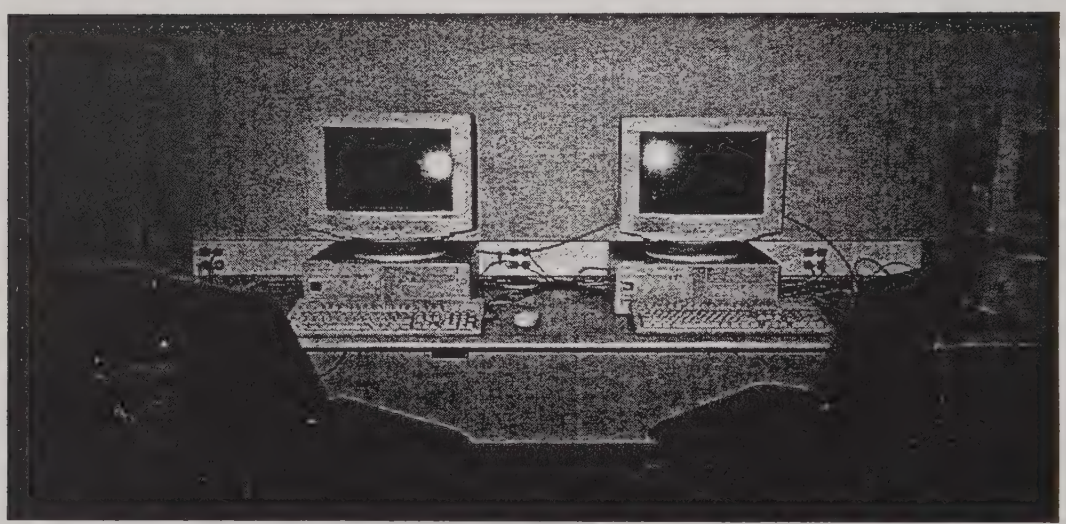
Case studies at Carnegie Mellon and Martin Marietta Energy Systems found poor ergonomics can lead to physical disorders known as cumulative trauma disorder (CTD). There are many types of common CTDs: carpal tunnel syndrome, tendonitis, adverse mechanical syndrome, and computer vision syndrome. The only prevention for these health problems is to make the workstation safer in terms of ergonomics.

The intent of my proposal is to prevent ergonomic health problems through the implementation of better equipment and to educate users by providing them with exercise pamphlets. Research shows that a fully-adjustable workstation works best. Based on the research, the changes will aid in the prevention of CTDs. Another preventive measure will be to provide exercise pamphlets for users, so that they can practice prevention anytime they feel pain while at the workstation.

Thank you, again, for all your time and concern for this project. Please feel free to contact me at (732) 555– 0722. I look forward to working with you for the benefit of our workstation users.

Sincerely,

An Ergonomic Approach for Improving Computer Workstations at the MSLC Computer Lab



Submitted to: **Vernie Coston, Assistant Vice President**

Committee on Computing and Information
Planning and Facilities Design
82 Street 102 Piscataway, NJ 08854

Submitted by: Writer's Name Deleted

Submitted Date: 12/11/00

ABSTRACT

The computer workstations at the MSLC computer lab are due for improvement. Computer. workstations have been around for a long time. However, it was only been few years since people have become aware of the health problems associated with the workstation. Rutgers is facing this very problem in the MSLC computer lab. According to a questionnaire, 48% of 33 workstation users are dissatisfied with the current conditions of the lab. These people also report health problems related to their workstations. These health problems can lead to Cumulative Trauma Disorder (CTD). If proper equipment is not implemented immediately, users can develop many types of CTDs: carpal tunnel syndrome, tendonitis, computer vision syndrome, and adverse mechanical syndrome. A fully-adjustable workstation would be the first key in preventing these health problems. Also, purchasing some inexpensive equipment like the DT keyboard tray, cordless mouse, ergonomic chair, and mesh screen should prevent the risk of CTDs. In addition to the new equipment, exercise pamphlets should be provided so that every user has the opportunity to learn of the risks and prevent them at the same time. Proper adjustments to the computer lab can prevent workstation health risks and create a more comfortable environment for our students.

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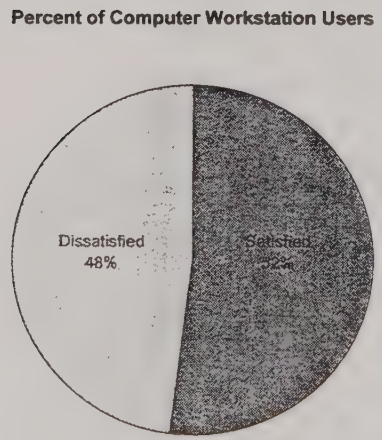
INTRODUCTION

U.S. engineers John Mauchly and John Eckert built UNIVAC 1 (Universal Automatic Computer), the first commercially available electronic digital computer in 1951. Workstations were soon created to accommodate this new technology. In the midst of the all this excitement over the newest machinery, health problems regarding workstations started to develop. This concern for workstation user health resulted in the field of ergonomics. The goal of ergonomics is to incorporate comfort, efficiency, and safety into the design of keyboards, computer desks, chairs, and other items in the workplace.

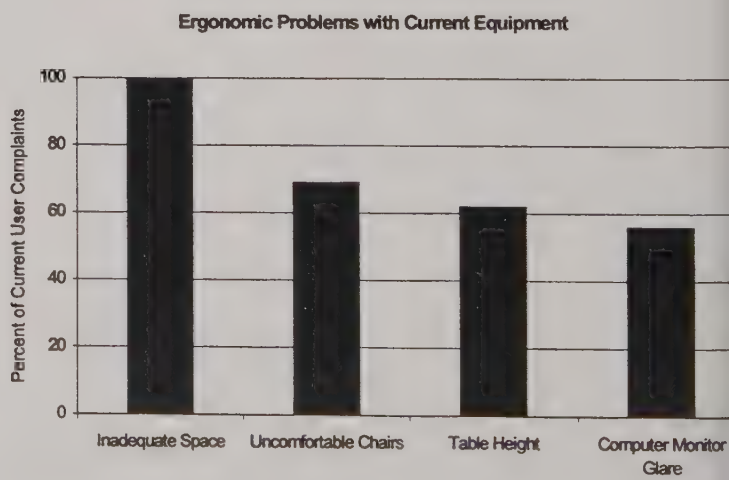
Ergonomic improvements at the computer workstations in the MSLC Computer Lab have been long overdue. Some of these improvements have to do with the current equipment at the workstation. A questionnaire completed by 33 current workstation users was used to determine the ergonomic problems with the current workstation. The questionnaire reports that 48% (see pie chart below) of the users are dissatisfied with the equipment at the lab. That is almost half of the current computer workstation users. The number one complaint is the inadequate space (see bar graph below along with other user complaints) available at the workstation for users to perform their tasks. The next popular complaint is regarding the chairs at the lab, which accounts for 69% of those that are dissatisfied with the lab. If not seated properly, users tend to flex their wrists in such an awkward position that it can increase the internal pressure in the carpal tunnel (Nanthavanij, 1994). The other complaints have to do with the table height (62% of those dissatisfied) and computer monitor glare (56% of those dissatisfied).

Figure 1: Satisfied/Dissatisfied Users



Source: Questionnaire administered to 33 users administered to 33 users

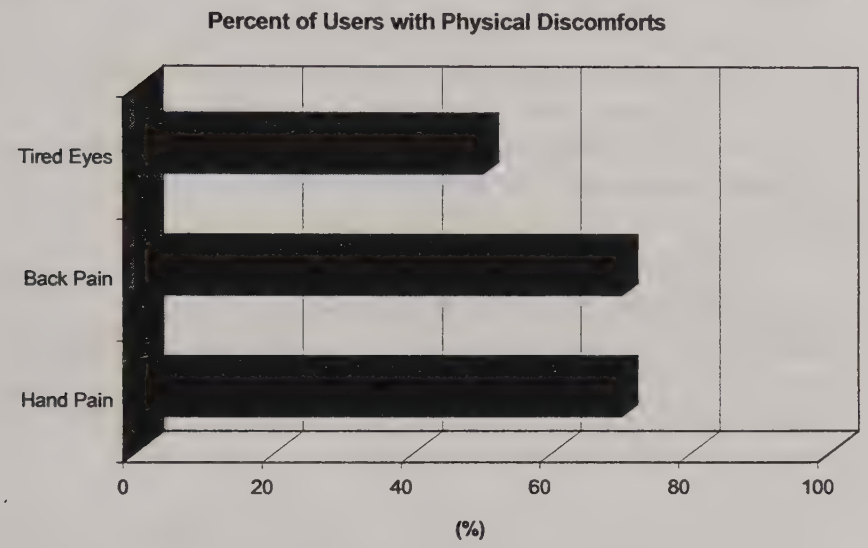
Figure 2: Equipment Problems



Source: Questionnaire

Those users that are dissatisfied with the equipment also report physical discomfort (see chart below). Out of those dissatisfied, 70% report both back pain and hand pain. Some studies have identified constrained and awkward wrist and forearm postures as contributors to hand and arm pain during keyboard-like activities (Serina et

Figure 3: Physical Discomforts



Source: Questionnaire administered to 33 users

al, 1999). Another major physical discomfort is tired eyes, which accounts for 50% of dissatisfied users. In 1991 in a study by Sheedy, optometrists reported that more than one out of seven patient visits in the United States – 10 million per year were due to vision problems related to computer use (Gaboury, 1999). This study shows the harmful effects of tired eyes, even though it is a general study and not one that is concentrated within Rutgers University. Other case studies are further discussed in the literature review.

LITERATURE REVIEW

Ergonomic Health Problems: Cumulative Trauma Disorder

Ergonomic factors are overlooked when designing or purchasing workstation equipments. Such a mistake could lead to many ergonomic health issues known as CTDs (Cumulative Trauma Disorders). CTD's are disorders of the musculoskeletal and nervous systems that may be caused or aggravated by repetitive motions, forceful exertions, mechanical compression, or awkward postures all occurring over extended periods of time (Marcel Bergerman & Mark Stahl, 1999). These disorders can occur in many parts of the body: wrists, elbows, shoulders, back, neck, hips, knees, and ankles. Repetitive movement adds up—it's cumulative, resulting in the term "cumulative trauma" (Armstrong, 1986).

CTD's are most often the result of repeated physical movements doing damage to soft body tissues such as tendons and muscles (Armstrong, 1986). The soft body tissues become irritated and inflamed over time. The repetitive motions/excessive force can strain the soft tissues which eventually reduces circulation. These stresses create tiny tears in the muscles and tendons, which become inflamed (Keogh et al, 2000). In severe cases, loss of coordination and grip strength may occur.

Types of CTDs

CTDs can be fatal in severe cases. There are many types of CTDs in this category. One of the most common types of CTD is the carpal tunnel syndrome. This disorder occurs when the nerves that run through your wrist into your fingers, get trapped by the inflamed tendons around them (Keir et al, 1999). Symptoms include feeling "pins and needles", tingling, numbness, and loss of sensation, pain or aching in the hands and arm (D'Arcy & McGee S, 2000). In severe cases, these symptoms can eventually result in the loss of coordination and grip strength (Pauda et al, 1998).

Tendonitis is another type of CTD that is also an inflammation of the tendon like the carpal tunnel syndrome. Repeated tensing of the tendon usually causes such an inflammation. Eventually, the fibers of the tendon start separating, and can even break leaving behind debris which induces more friction, more swelling, and more pain (Armstrong, 1986). The most common type of tendonitis is sub-acute tendonitis, which entails a dull ache over the wrist and forearm, and it gets worse with repetitive activity (Mani & Gerr, 2000).

A third type of CTD is the computer vision syndrome, which is mainly due to staring at our computer screens for too long. Symptoms include tired eyes, eyestrain, sore eyes, periodic blurred vision, headaches, dry eyes, glare sensitivity, and neck, shoulder, and back pain (Von Stroh, 1993). These symptoms haven been collectively described as

Computer Vision Syndrome (CVS) by the American Optometric Association (Journal of American Optometric Association, 1996).

Adverse Mechanical Syndrome (AMS) is another type of CTD, which is also known as "neural tension". This disorder occurs where the nerves that run down your arm become contracted and possibly compressed. It's the result of muscle spasms in the shoulders and elsewhere (Egol, 1998). AMS and the other types of CTDs are related to computer workstation use.

Case Studies: Martin Marietta Energy Systems and Carnegie Mellon

Prolonged computer use, repetitive keying, awkward postures and psychosocial issues have been associated with injuries described as cumulative trauma disorders (CTDs), says Hochanadel, (1995). In his case study, over 3300 people at Martin Marietta Energy Systems participated in a program to improve workstations by completing a computer questionnaire. Out of 3300 people, 1615 reported pain/symptoms associated with computer use. These symptoms consisted of a range of pain from back to eye pain. Three of the factors that attributed to these symptoms were height problems (table height), mechanical problems (inadequate work area), and lighting (images or glare reflected from screen).

Research by Bergerman and Stahl (1999) at Carnegie Mellon agrees with Hochandel's (1995) case study. Several people at the Electrical and Computer Engineering (ECE) department have been suffering from workplace related injuries, notably repetitive stress injuries (RSI) from long hours of typing at a computer workstation (Bergerman & Stahl, 1999). These injuries are RSI, which is another name for CTD. The CTDs found at the ECE department mostly consist of tenosynovitis, tendonitis, carpal tunnel syndrome, adverse mechanical syndrome, and other CTDs. When you're typing too much, you're never really giving a chance for the blood to get back where it belongs, because your muscles never relax enough to let the blood through (Bergerman & Stahl, 1999). The central issue of the Carnegie Mellon research and Hochanadel's (1995) case study is: poor ergonomics can lead to physical disorders known as CTDs.

Ergonomic Equipment Method

There are many types of ergonomic equipment that help re-design workstations and prevent disorders like CTDs. The main question is to figure out which type of workstation is suitable for everyone. A study consisting of six population groups in Thailand suggests a fully-adjustable workstation to be the most effective using IntelAd (an Intelligent Computer Workstation Adjustment System) (Nanthavanij, 1994). The six population groups consisted of 3 male groups and 3 female groups of different height and weight.

Table 1
Heights and/or Adjustment Ranges of Reference Points

	Category of VDT Workstation	Height/Adjustment Range (cm)		
		Seat	Keyboard	Monitor
1	Fixed-Height	43	77	113
2	Partially Adjustable	40-49	63	113
3	Fully Adjustable	40-49	58-71	113-130

Figure 4: Heights and/or Adjustment Ranges of Reference Points

Source: Nanthavanij, (1994).

These population groups were used to test three types of workstations involved in this study: fixed-height, partially-adjustable, and fully-adjustable. According to the table above, fixed-height workstations have no adjustment ranges while the partially-adjustable workstation has adjustment ranges in the area of seat only. However, the fully-adjustable workstation has adjustment ranges in all areas: seat, monitor, and keyboard. Therefore, fully-adjustable workstations are the ideal units where computer users are able to independently adjust key components such as chair seat and keyboard tray to their desired seated posture.

Types of Ergonomic Equipment

Correct seating posture is very important in the design of a fully-adjustable workstation. While there are several factors that contribute to the development of carpal tunnel syndrome, perhaps the most frequently cited one is an incorrect seated posture of computer users (Nanthavanij, 1994). An easily adjustable ergonomic chair could be a good solution to correcting seating posture in turn preventing health hazards. Thomas (1999) states that adjustable ergonomic chairs can prevent neck and shoulder injuries.

Downward-Tilting (DT) keyboard trays are very beneficial and cost-effective for a fully-adjustable workstation. In a case study of thirty-eight professional workers, over 80% typed

better with the DT system than with keyboard-on-desk arrangement. Within 3 weeks of using the DT system there were significant improvements in rating of shoulder and lower

back discomfort, and a trend for reductions in discomfort for other upper body areas (Hedge et al, 1999). A mouse pad that can be adjusted with the keyboard tray is also a favorable idea. Awkward postures were not seen for subjects with the DT system because they had positioned their adjustable mouse pad to allow their right shoulder to remain close to the body during mouse use (Hedge et al, 1999). This system of keyboard tray with mouse pad attachment will provide the workstation with sufficient space for users to perform tasks.

Convenient computer mice are essential to a fully-adjustable workstation. One study found that strenuous wrist and shoulder postures are maintained for a greater percentage of time while using the mouse than using the keyboard (Keir et al, 1999). Therefore, design of mice are also significant to the prevention of CTDs. Cordless mice are best ergonomic alternative because they eliminate the constraint of placing it within a certain distance of the computer. Also, the cordless mouse reduces wrist extension of unnecessary cord-pulling to adjust the position of the mouse. This correlates with Keir et al's recommendation: we suggest that efforts be made by manufacturers to reduce the wrist extension associated with mouse use (1999).

Fully-adjustable workstations should also be able to reduce computer monitor glare. Specifically, the reflections from a computer monitor can adversely affect the ability of millions of computer users to read and comprehend information (IIE Solutions, 1999). In a study of eye fixations during visual tasks, subjects complained of eyestrain, headaches, blurred vision, irritated eyes, neck, and backaches (Yagi et al, 1998). These discomforts can be prevented with the use of a mesh screen for computer monitors. Users reported of less glare when using displays that had a vacuum deposit coating (Gaboury, 1999). This type of equipment is just one of many ergonomic workstation equipments that help prevent potential health problems. Other types of equipments to used to avert health problems will be further discussed in the procedure section.

PROCEDURE

Objective:

Poor ergonomics can lead to potential health problems like Cumulative Trauma Disorder (CTD). Many case studies show that workstation users suffer from CTDs due to bad equipment. The objective of my project is to prevent these health problems by making sure that the current computer lab is ergonomically fit and that the users are educated about health risks at workstations.

Choosing Ergonomic Equipment:

Good ergonomic equipment can prevent health problems at workstations if implemented properly. There are many types of such equipment available to the public: keyboard-trays, adjustable chairs, split-keyboards, cordless mouse, adjustable tables, etc. The ergonomic equipments chosen for the MSLC computer lab are: downward-tilting keyboard-tray with adjustable mouse pad, adjustable ergonomic chairs, cordless mouse, and mesh screens for the monitor.

The downward-tilting (DT) keyboard tray (Figure 5) was chosen because studies show it to be more effective than keyboard-on-desk arrangement. The DT keyboard trays with the adjustable mouse pad should also clear up 1.54' of workspace, which is 63.9% of the available width for the work area. This will allow users more workspace as opposed to their number one complaint about inadequate workspace.

Another type of equipment that will help clear up workspace is the cordless mouse (Figure 6). It can be placed on the adjustable mouse pad along with the DT tray. This combination of DT keyboard tray with adjustable mouse pad and cordless mouse will clear up 1.79' of workspace, which is 73.1% of available width for the work area.

Figure 5: DT Keyboard Tray

Source: Alimed Equipments

Figure 6: Cordless Mouse

Source: Alimed Equipments

Correct seat posture is crucial in preventing health related injuries at the computer workstations. An adjustable ergonomic chair (Figure 7) is a necessity in this case. This particular chair will be very simple to adjust unlike the current chair, which according to the current computer lab consultants may or may not even have a mechanism for adjustment. The chair will have adjustment ranges in the areas of height and back comfort. This way users can control their posture and comfort.

Many people stare at their computer monitors for long periods of time. A preventive measure for such a case is good mesh screen (Figure 8) for the monitor. The vacuum deposit coatings on the screen prevent glare from reaching the users eyes.

Figure 7: Adjustable Chair

Source: Alimed Equipments

Figure 8: Mesh Screen

Source: Alimed Equipments

Personnel:

The following is a tentative list of the personnel and contractors needed for this project.

- Project Coordinator : Moumita Ghosal
- Handyman : 2 Outside Contractors
- Project Administrator : 1 Staff Member
- Workers : 3 to 4 Lab Consultants to carry equipment
- Donation Depot : Donations Clearing House Furniture Assistance Program
- Software Installer for Mouse : 2 Lab Consultants
- Ergonomic Chairs (24) : Alimed Equipments
- DT keyboard trays(24) : Alimed Equipments
- Logitech Cordless Mouse(24) : Office Max
- Anti-Glare Mesh Screen (24) : Alimed Equipments
- Pamphlet Committee : all MSLC staff
- Graphic Designs/Printing Pamphlets (24) : Blue Diamond Graphics
- Maintenance : 2 Lab Consultants
- Future Surveyors : Lab Consultants

Lab consultants that participate will be paid overtime for help on this project. All faculty will be asked to volunteer some work time for the benefit of the computer lab. The project administrator will continue with management of the lab in terms of ergonomics and maintenance with help from the maintenance people. The contractors have been selected on the basis of previous work record and efficiency.

Tools needed for Equipment Implementation:

The following are tools and materials needed for the equipment implementation. However, the quantities will depend largely on the final plans.

- Power Drill/Driver
- ½ " Drill Bit
- Measuring Tape
- ½ " Screws

Equipment Implementation:

Week 1: *Purchasing Equipment*

The project coordinator and the project administrator will get together and contact suggested workstation equipment vendors. They will place orders of the workstation equipments with the vendors. The delivery of the equipments will take from 1 to 3 weeks depending on the vendor.

Week 2 – Week 3: *Removing Current Equipment from Lab*

The project administrator will contact suggested places for current furniture donation. The workers will carry out the current chairs and mice for the donation depot.

Week 4: *Implementing New Equipment at the Workstation*

Assuming that all the equipment has arrived by this time, the workers will haul all the equipment to the MSLC computer lab. They will arrange the new chairs accordingly with the desks. The handymen will attach the DT keyboard trays to the desks using the supplied tools. The software installers will remove the current mouse software and install the new cordless mouse software. The MSLC computer lab will be closed to students except staff for this week.

Designing Pamphlets:

Week 1: *Brainstorming Pamphlet Ideas*

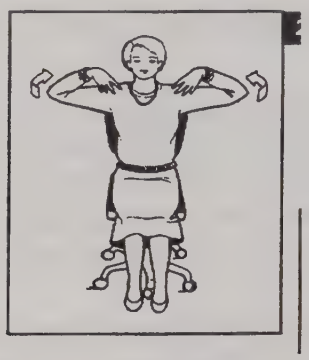
The project administrator and the Pamphlet Committee will get together to discuss suggestions and final outline of the pamphlet.

Week 2: *Designing Pamphlet Prototype*

The Pamphlet Committee will create a final pamphlet prototype on paper. Graphics for the pamphlet will be similar to figure 9. Final exercises and graphics to be put in the pamphlet will be discussed with the project administrator and the project coordinator.

Figure 9: Sample Pamphlet Graphic

Source: Schering-Plough Ergonomics Dept.



Week 3: *Printing Pamphlets*

The project administrator will take the final pamphlet design plans to Blue Diamond Graphics. The final exercise pamphlets will take approximately one week to complete.

Week 4: *Distributing Pamphlets to Workstations*

The final exercise pamphlets should arrive. The workers will put a pamphlet at every workstation with a "DO NOT TAKE FROM COMPUTER LAB" sticker on each pamphlet.

Follow-up Questionnaires:

Week 5: *Administer Questionnaires*

The future surveyors will administer similar questionnaires to all workstation users.

They will recommend adjustments to the project administrator who will take it in their discretion to grant approval.

Maintenance:

The computer lab improvements should require little maintenance. The maintenance people only need to look out for equipments to be working properly. In the case that the equipment fails to work, the maintenance should try to fix the problem or contact the proper vendor from who they purchased the equipment.

Project Schedule:

June 4, 2001	Purchasing Equipment and Brainstorming Pamphlet Ideas
June 11 - 15	Removing Equipment from Lab and Designing Pamphlet Prototype
June 18 - 22	Removing Equipment from Lab and Printing Pamphlets
June 25 - 29	Implementing New Equipment to Workstation and Distributing Pamphlets
July 2	Administer Questionnaires

A follow-up of the questionnaire will be conducted every month. This will help determine any new problems users are having The project administrator can then judge what necessary steps should be taken to fix these problems. Also, maintenance will check the equipment and the condition of the lab every alternate week.

BUDGET FOR 24 WORKSTATIONS

(1) Labor:

- Graphic Designers (Pamphlets@ $30 each, Blue Diamond Graphics)……$ 720.00
- Service Technician……$ 265.00
- Lab Consultants (about 8 @ 123.60 per day)……..$ 3090.00

(2) Equipment Costs:

- DT Keyboard Trays (@ 189 each, Alimed Equipments)……$ 4356.00
- Cordless Mice (@ $39.95 each, Office Depot)……..……$ 958.80
- Mesh Screen (@ $19.95 each, Alimed Equipments)……...$ 478.80

- Ergonomic Chair (@ $275 each, Alimed Equipments).....$ 6600.00

(3) Tools:

- Power Drill/Driver (comes with Drill Bits, Sears).....$ 60.00
- 1/2" Screws (about 96 screws).....$ 6.00
- Measuring Tape.....$ 3.00

(4) Total:

- Total.....$16,537.60

Discussion

Computer workstations have been around for a long time. Present research on the workstation indicates an alarming number of health risks associated with the workstation. These health risks mainly occur from poorly designed equipment. The current equipments at the MSLC computer lab are lacking ergonomic safety. This is causing major discomfort for our workstation users. Of 33 users who responded to the questionnaire, 48% (see figure 1) were found to be unhappy with the current conditions of the computer lab. Our primary concern is to prevent discontentment among our users while maintaining an ergonomically safe environment. The proposed plan should do just this.

The first part of the plan for purchasing ergonomic equipment will help prevent health risks such as CTDs. It will also make the workstations comfortable and safe for our users. In addition to these equipments, users will feel secure with the newly developed exercise pamphlets. The exercises in these pamphlets are going to be designed

for the prevention of all kinds of CTDs. Users will be able to practice these simple exercises anytime they feel pain while working at the workstation.

The computer lab should be a place for our users to perform their tasks at ease. All it requires is a few easy adjustments to the computer workstations. The safety and contentment of our users is priceless. By implementing this plan, we will not only create a safe computing environment for our workstation users, but also provide them with a sense of security.

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APPENDIX 1: QUESTIONNAIRE

I am an Industrial Engineering student, working on a project to improve the computer workstations. I would really appreciate your input. Please fill out this questionnaire.

1) Are you satisfied with the current computer workstation?
   ☐ yes ☐ no

   If you answered no to the question above, please answer the following set of questions.

2) Do you think that the lighting in the room provides:
   ☐ Low visibility ☐ moderate visibility ☐ high visibility

3) Do you get a glare from the computer screen
   ☐ Never ☐ Sometimes ☐ Often

4) Do you feel that you have enough space at the computer workstation to perform your task?
   ☐ yes ☐ no

5) Is the table height:
   ☐ Too Low ☐ Ok ☐ Too High

6) Are you having trouble typing on current keyboard?
   ☐ yes ☐ no

   If you answered yes to question 6 please answer question 7:

7) Do you think you can type better with ergonomic keyboard?
   ☐ yes ☐ no

8) Are the chairs comfortable?
   ☐ yes ☐ no

   If you answered no to questions 8, please answer the following.

9) Do you get: (please check any that apply)
   ☐ Backaches ☐ Headaches
   ☐ Hand Pain ☐ Finger Pain
   ☐ Tired Eyes ☐ Leg Pain
   ☐General Muscle Pain

10) Are the chairs easy to adjust to height and comfort:
   ☐ yes ☐ no

Supplementary Materials

The following materials include exercises, assignments, and peer review sheets to use in class. More supplementary materials can be found online at the Business and Technical Writing web site: http://bizntech.rutgers.edu.

Newspaper Exercise

Preparation

To participate in this exercise, you must read several newspapers and choose **one** article that could be the basis for a project proposal. The best articles will suggest a problem that you can imagine trying to address. The purpose of this exercise is *not* to get you to choose the topic that you will actually work on for this class (though it is possible that some of you might stumble upon your topic this way). Rather, this exercise is intended to get you to practice the process of project development. After reading the coursepack Introduction, take notes on the 5 P's of your article. This will be collected.

In Class

Get into groups of four or five, and do the following:

1) Each of you, in turn, should present your article to the other group members. Describe the article and explain this might make a good project. (About 10 minutes)

2) After the individual presentations, decide, as a group, which of them would make the most interesting basis for a project. (About 5 minutes)

3) Elect a group leader. This person does not have to be the one whose article was chosen, but he or she will present your ideas to the class. (About 5 minutes)

4) Once you have elected a group leader, begin developing a project idea based upon the article and on your own general knowledge. Obviously, to develop a strong project you would have to do research, but do the best you can. Use the following questions as a guide to discussion: (About 20 minutes)

   - Problem. What is the basic problem or need your project will address? Why is it a problem? How could you illustrate the extent of this problem?

   - People. Who is affected by this problem? What specific population will your project serve? Who might fund your idea? Why would they fund it?

   - Paradigm. What disciplines (e.g.: marketing, education, nutrition, medicine, etc.) might be useful in addressing this problem? What research would help?

   - Plan. How might you address the problem you have identified? What is your plan of action? Who will carry out this plan? What resources or assistance will you need? How much do you think your project might cost?

5) Present your ideas to the class and answer any questions (5 minutes for each group).

Peer Worksheet for Reviewing Proposal Ideas

In reading and commenting on proposal ideas in your peer workgroup, consider whether each writer's proposal does all of the following:

1. **Identifies with people.** Does the writer have a particular reader (or funding source) in mind? Does the writer's approach seem appropriate to the reader's concerns? Should the writer imagine a different reader for the idea or find out more about the reader's concerns? Does the project address the needs of a particular population? Might the interests of the reader differ from those of the population to be served? How so?

2. **Points to a problem.** Does the writer demonstrate a need for this proposal? Has he or she discussed a problem that could be researched and documented? How might the writer find out more about the problem? What sources of information might be helpful? What type of evidence would help illustrate the problem better?

3. **Faces complexity.** Is the idea of sufficient complexity to require a detailed proposal? If not, can you suggest ways to develop the project so that it would be adequately complex? Has the writer considered all the major problems here, or is there something he or she is avoiding?

4. **Suggests lines of research.** Does the topic lend itself to library research (a course requirement)? What other kinds of research should the writer consider? How might the writer support his or her claims about the problem suggested by the proposal?

5. **Positions the work within a paradigm.** Does the writer have a definite approach to the problem or issue? How might the writer position him or herself within a discipline or field of study in approaching the topic? What disciplines might be helpful? What research might the writer pursue in developing the paradigm?

6. **Demonstrates originality.** Is the specific work proposed at least somewhat original? Has this idea been tried before? What could make this idea more innovative? Are there other ways of approaching the problem?

7. **Stays within reach.** Is the proposed idea manageable? In other words, is the scope of the proposed work something that can be done well, given the timeframe and resources? Is the student remaining within his/her reach if not his/her grasp? Is the idea focused enough in terms of population, location, or issue? Is it something that could actually get done? Can you see this student actually taking on such a project now or being able to do so within the next few years?

Please provide written and oral feedback for each person in your workgroup for each of these areas. Make this an opportunity to brainstorm and develop each other's topics.

Computer Lab Day—Topic Proposal Rough Draft Revision

1. Go to either Microsoft Word or Corel WordPerfect. Type in your topic proposal and funding source statement. Once everyone has done that, we will begin.

2. At the signal, everyone should move to the next terminal to the right. Read the proposal and funding source statement and then scroll down to the end. Enter your initials and comment critically (meaning good and bad criticism) on the proposal. When you are done, move to the right again and repeat the process until you have read everyone's work and are back at your own terminal. Don't skip from machine to machine out of order, or the whole system will break down. Be patient and wait a minute. Conversely, don't hold up the line by writing a dissertation on the proposal—a few good sentences will do.

3. If you are having a hard time thinking of something helpful to say about the topic proposal, you may read and comment on other people's comments. If you think someone else's suggestion is good or bad, say so, referring to that person's initials.

4. Once we are all back "home," save the file on your disk under a recognizable name like "proposalcomments."

5. Review all of the comments and use them to help you write your final draft of the Topic Proposal and Funding Source Statement.

6. Once you have received approval of your proposal from your instructor, you can get started on your Annotated Bibliography.

Annotated Bibliography Assignment

The quality of your final project will depend on the quality of your research sources. The best time to start researching is now! Realize that you will find and discard many sources along the way. Review the Research section of the Coursepack and prepare an annotated bibliography, following the guidelines in the APA Style Guide.

Your annotated bibliography should be an alphabetized and properly cited list of at least six sources, three of which must be academic-quality (i.e.: books, scholarly journals, or information from research center websites). In addition, you can include articles from professional or trade publications, on-line information, newspaper articles and other materials you think will be helpful for a minimum of six total items. You should begin your research at your library homepage. Refer to the website for other web guides that offer help to students, especially on finding sources of grant money, statistical information, and government information.

Set up your bibliography like a regular APA references page, with properly formatted entries, in alphabetical order, double spaced, with the first line of each entry tabbed in. After the entry, include approximately three sentences describing how this source will be useful to your project. See the Sample Annotated Bibliography at the end of the Research section for an example.

Directions for in-lab peer revision of Midterm Paper

One of the main purposes of the midterm sales letter is to get your funding source interested in your idea. You can do that by being as clear and direct as possible in the way that you explain what you propose to do, and you can try and structure your argument so that the benefits to your funding source or its mission are clear. Today, along with the usual stylistic peer revision work, we will use the computer to highlight those places in the draft which may or may not appeal to the funding source. The focus of your attention today will be to remember that these letters are WRITTEN FOR AN AUDIENCE.

1. Insert your disk and pull up your rough draft.

2. Switch terminals with someone else and review each other's work.

3. a. Write your name at the top of the peer revision sheet as reviewer, and the writer's name.

   b. Read through the paper once; then start over, paying careful attention to the tone and the way the writer addresses the audience. If you see any passages where you think the writer needs to be more diplomatic in tone, highlight them in red. Highlight passages in green where the writer is doing a good job relating his or her concerns with the funding source's objectives or goals. [Notice the color symbolism!]

   c. If you see misspellings or awkward grammar, highlight those passages in yellow.

   d. Using the peer revision sheet from the coursepack, check off the yes and no answers at the top.

   e. At the end of the person's draft, answer the numbered questions from the handout. Alternatively, you could make comments in brackets directly in the writer's text as close as possible to passage in question.

   f. When you are done commenting, please save the new file, using the Save As function—don't cancel out the person's original draft. I suggest naming the file "Rdcomments.doc" or something like that.

6. If you have any bibliographic format questions which cannot be answered by the APA style guide in the coursepack, try doing a web search to find what you need to know.

7. Switch with your partner and go back to your original terminal. Discuss with each other the comments you have made, and provide suggestions as to how the draft can be made more appealing to the funding source.

Midterm Paper Workshop

Please fill out the following form for your partner and write on his or her draft.

Basic Requirements

1. Does it follow the format required the instructor? ___ yes ___ no
   - Is it appropriately in letter or memo format? ___ yes ___ no

2. Is it addressed to the appropriate audience? ___ yes ___ no
   - Does it discuss why the reader is appropriate? ___ yes ___ no

3. Does the writer open by describing a problem or trend? ___ yes ___ no
   - Is the problem or trend adequately *documented*? ___ yes ___ no
   - Does the writer *quantify* the problem in some way? ___ yes ___ no

4. Does the body of the letter:
   - Argue in a way that would appeal to the *audience*? ___ yes ___ no
   - Refer to specific *evidence*? ___ yes ___ no
   - Offer specific *examples* or details from sources? ___ yes ___ no
   - *Focus* on a specific paradigm? ___ yes ___ no
   - Offer a *researched rationale* for the plan? ___ yes ___ no

5. Does the writer describe the plan? ___ yes ___ no
   - Does it *follow logically* from the research? ___ yes ___ no

6. Does the writer invite the reader to his/her presentation? ___ yes ___ no

7. Is the *bibliography* prepared according to APA style? ___ yes ___ no

The Content

1. Briefly state, in your own words, what the writer is arguing and hoping to accomplish:

2. Why should the reader be interested in this proposal, *in your own words*? What more might interest this specific reader?

3. What proof does the writer offer to support his or her argument? What evidence is strongest? Weakest? Why?

4. What further research should the writer consider?

Graphic Aids Assignment

Visual aids are an important part of both your oral presentation and your final project. They can provoke an immediate response in your audience in a way that a paragraph of statistics may not. In preparation for your oral presentation, bring in at least three visual aids with stapled commentary.

These three visual graphic aids should be cut from newspapers or magazines, or printed out from online sources. They could be ones that you are considering using for your oral presentation and project proposal, but they could also just be interesting examples of graphics. Please do not bring in pictures or photographs; I would much rather have you find images which are **visual representations of statistical information**, as in charts, tables, graphs, and so on. You may find certain graphics that you find misleading, and would like to show the class possible "sneaky" tactics used by the presenters. To help you develop good, informative, attractive visual aids, we will look at your examples and some others in a peer review/class presentation session.

These will be handed in: please staple them to a piece of paper and write down some notes about what you thought of each one. Don't give me your only copy, especially if you are one of the first people scheduled for oral presentation. If you are confused as to how to comment, you can refer to the five legitimate functions of a good visual found in *The Portable Business Writer*.

Oral Presentation Evaluation Form

Speaker _____ **Date** _____

Title / Topic _____

Start Time _____ **End Time** _____ **Your Initials** _____

People **1 2 3 4 5 6 7 8 9 10**

Did the speaker address the concerns of the *funding source*? Did the speaker address the needs of the *group to be served*?

Problem **1 2 3 4 5 6 7 8 9 10**

Does the speaker present convincing *evidence of a problem*? Has the speaker defined or *quantified it?*

Paradigm **1 2 3 4 5 6 7 8 9 10**

Does the speaker present a *researched rationale* that supports the specific plan of action? Is there *sufficient research to justify the plan*? What type of research would help to justify the plan more fully?

Plan **1 2 3 4 5 6 7 8 9 10**

Does the speaker organize the plan in a *coherent and logical* way? Does the plan *follow from the paradigm* and provide a solution to the problem as it is defined? Could the plan be *visually represented* in a useful way?

Price **1 2 3 4 5 6 7 8 9 10**

Has the speaker carefully *calculated the cost* of the project? Is anything left out that should be included?

Poise **1 2 3 4 5 6 7 8 9 10**

How well did the speaker maintain eye contact, enunciate, point to the visuals, and project confidence?

Pictures **1 2 3 4 5 6 7 8 9 10**

Were the visual aids useful and professional? Was there something more that should have been pictured?

Overall **1 2 3 4 5 6 7 8 9 10**

Please explain your overall impression, and continue onto the back of the page if necessary...

Procedures Manual Assignment

For many technical writers, writing good directions to other people on how to do something is an integral part of their job. Researchers must document their research procedures, industrial technical writers must often write the instruction manual that accompanies a new product. As with all technical writing, an awareness of your reading audience is crucial to writing a good procedures manual.

As you work toward your final project, think about the Plan section. Many people at this point have a good general idea of what they want to do, but have not considered the specific details involved in carrying it out successfully. Taking some time now to think about the details, amounts, and materials will help you have a clearer idea of the project as a whole. Without attention to the details, you won't be able to generate an accurate budget.

First, consider who will be doing the project or the research. How much do they know? How much do they need to know? Are they professionals or volunteers? How specific will you have to be? Then, consider your funding source. How much do they know, or need to know? What level of specificity would be appropriate in explaining your project to them?

You have two choices in this assignment.

1. You could write a set of directions to the people who will be helping you carry out the project. For instance, if you are starting a soup kitchen, you might write up a set of directions as to how you will serve the people who come to eat. Will you have a buffet style or a sit-down service? Will you allow seconds? What should a worker do if a soup kitchen guest wants to use the phone or needs a ride? You could incorporate this assignment into your final project as an appendix.

2. You could generate a list of procedures in order to demonstrate to the funding source how the project will be carried out. This differs from #1 because it is less detailed and broader in perspective. The stages you might write about setting up a soup kitchen might be to find an adequate space, to make arrangements with the USDA for free food donations, to train workers, and to advertise the opening day. You could expand this assignment and make it your Plan or Procedures section of the final project.

The most important thing to do in writing instructions is to figure out the logical sequence of events. What must come first, what logically comes second, and so on?

Using either #1 or #2, write up a brief one-two page procedures manual. Explain each step as thoroughly as possible.

Peer Revision Day for Final Project Proposal

1. The first thing you should do is to check and see that your partner has every required section IN THE RIGHT ORDER. Each section should start on a new page (the only exception would be if the writer wanted to combine the Table of Figures and the Table of Contents on one page).

2. Check to see that each section contains what it is supposed to contain. This is the most crucial issue to look for on Rough Draft #1. Invariably, people have too much plan in the Introduction or too much problem in the Research.

3. Check the format throughout. Check simple things like the pagination and the appearance of the title page. Is the funding source listed as the organization to which the project is being submitted? Is there a date of submission? Is everything capitalized uniformly? What could be done to improve the aesthetic impression of the title page? Everything should look as clean and professional as if the actual money you are requesting rested on the impression you create by handing it in. How much is a bit of polish worth to you?

4. Critique your partner's letter of transmittal. [Remember, your letter should be paper clipped to the actual project—it should not be stapled or bound in.] Does it include some reasoning as to why the particular funding source will be interested in the project? Does it ever so briefly outline the main themes of the project—problem, paradigm, plan? Does it follow standard business letter format? IS THE LETTER SIGNED?

5. Starting with the Abstract, look over the whole project to see that all section subheadings are uniform. If one is centered at the top of the page, they all should be. If one is in bold, they all should be. The same font should be used for each section heading. Ask these questions about the abstract itself: Is it dispassionate? Is it just an objective summary of the contents of the project? Does it contain some reference to the main thrust of each section of the project? Yes, you will be repeating yourself, but that's okay.

6. Do you like the looks of the Tables of Contents and Figures? Why or why not? What could be done? Are titled subheadings within the sections given along with page numbers for easy reference?

7. Check to see if the writer is citing all information that needs to be citing, and that he or she is using the proper format. Use your citation style guides to help you here.

8. Has the person thoroughly described the problem in the Introduction and provided all the research necessary to show that the problem exists? Is the problem (or aspects of it) quantified?

9. Comment thoroughly on the writer's Literature Review or Research section. This is the place for needed background information, your case studies, and failure analysis of why previous attempts to fix the problem didn't work. Include the research geared toward your solution as the last section in your Literature Review.

10. Procedures: Is the plan specific enough to be carried out by anyone reading it? What is missing? If you were the funding source, what would you want to see? A timeline is always a good idea: when will data be gathered, how long will it take to process it, what will be done with the results by what deadline, etc. Without a set time for completing a project, a proposal seems vague and undefined. Not including times is almost as bad as not including a budget.

11. Budget: Check if your partner's budget is thorough enough. Remember to include donated items and estimated costs. Try not to leave anything out! It would be better to overbudget a bit than to underbudget. Any necessary explanation can be done in a paragraph under the budget table. If there is a difference between start up costs and continuing costs, then have two separate tables, one for the first year/month/week (whatever increment you are using) and then one for the rest of the period. After that, you need a short table adding all the other budgets together for your total requested funds. The main things to look for when checking the budget tables are comprehensibility, comprehensiveness, legibility, formatting, explanation, and, of course, proper addition [I have a calculator if you need one.]

12. Discussion: You are looking for two things here: a summation of the entire project (problem, paradigm, plan) and some method of evaluating the results of the project. This might involve discussing other positive implications that the project may have, provided they fit in with the funding source's mission.

13. Bibliography: To be consistent with APA style, the bibliography should be double-spaced. Make sure as you check back and forth that each cited bit of research can be found easily on the bibliography. The in-text citation may need to be changed for easier reference. See if the person needs more entries, and suggest expansion if all of the entries are from the same kind of sources. For instance, if the whole thing is web reference, then suggest a book or article. If there are no internet sources, suggest finding one. If all of the sources are from the web, suggest finding some hard copy sources as well.

14. Appendices: You need to refer to all of your references in the text, as in [See Appendix I, p. 18] Even if you are copying a page out of a book, insert the proper format.

Final Suggestions for Technical Writing

Any technical writing, whether in a business or research atmosphere, involves a level of practicality that may be missing from other kinds of academic work. In simple terms, *keep the real world in mind at all times*. Don't get so carried away with theories, concepts, and models that you forget the true purpose of technical writing: to make something happen in the real world.

In order to do that well, remember the following suggestions:

1. Be aware of your own perspectives and motivations in writing, especially if you are personally involved in the project. Try to maintain and project an objective stance toward your project.

2. Know the expectations, background knowledge, and motivations of your audience. Whenever possible, connect your project to their perspective.

3. If you are working for an employer, be aware of the perspectives and motivations your company or the person directing the research.

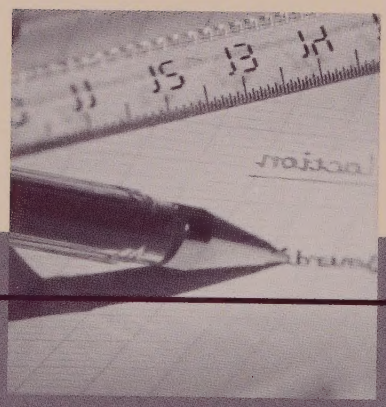
4. Use numbers well. Document the problem you are addressing through the use of numbers. Use numbers to show the effectiveness of the models, concepts, or theories that make up your paradigm. Have a firm grip on the numbers involved in carrying out your plan—how long, how many people, how much material, how much cost—and be ready to defend that with evidence.

5. Explain the numbers you are using to your audience and make them relevant to their concerns. Use your knowledge of #2 above to help you here.

6. Use graphics well to aid you in communicating your information, and explain them in the text.

7. Write clearly and concisely, and keep the focus on your purpose rather than the information. Yes, you need information, but only in order to put it into action—keep thinking *applied* knowledge rather than abstract knowledge.

8. Back up what you say with good sources—research, statistically legitimate surveys, quotations, reports, articles, etc. Make these as recent as possible in order to be valid in an everchanging research climate.



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